Electrical World

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The 10th Anniversary

of

BETTER LIGHT
BETTER SIGHT

or

A PRELUDE TO THE
RELIGHTING OF AMERICA

Still the SPEARHEAD

in the drive for BETTER LIGHT-BETTER SIGHT

A decade ago, the WESTON Illumination Meter was the basis for the original Better Light — Better Sight campaign. Its development made possible, for the first time, the measurement of illumination efficiency in terms that were scientific, constant, and readily understood.

And today, a WESTON Illumination Meter, *but of an advanced* type, still spearheads the crusade. Equipped with the exclusive WESTON VISCOR filter it provides direct measurement of light of any type or color composition, without correction factors. Whether you measure daylight, neon, incandescent or fluorescent, you get a direct, accurate measurement with Viscor filtered WESTON Illumination Meters.

Thus in light measurement, too, WESTON'S pioneering achievements are only mile-posts in an endless, upward march. The engineering skill that fathers them keeps pace with progress . . . *Keeps constantly leading the way.* Weston Electrical Instrument Corporation, 578 Frelinghuysen Avenue, Newark 5, New Jersey.

WESTON

DIRECT-READING

Illumination Meters

Model 703 Sightmeter — equipped with the stable WESTON VISCOR filter.

Model 603 WESTON Illumination Meter (VISCOR filtered)

Model 614 WESTON Illumination Meter (VISCOR filtered)

Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transformers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.

WESTON

Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters...Aircraft Instruments... Electric Tachometers...Dial Thermometers.

FOR OVER 50 YEARS LEADERS IN ELECTRICAL MEASURING INSTRUMENTS

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 70 YEARS

July 22, 1944 — Vol. 122, No. 4

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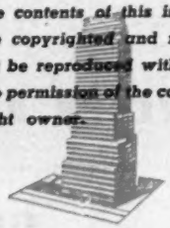

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Please change my address on Electrical World

From .....

.....

To .....

.....

Signed .....

HAZARD CABLES

to fill many needs...

The wide range of cables made by Hazard provide for many problems met in the course of the day's work. Here are examples, designed for specific requirements and built to withstand a number of severe conditions. Hazard research and experience are at your command to help in choosing the right cable for the right job.

HAZARD SERVICE CABLES FOR SERVICE DROPS AND ENTRANCES

Type SE (ABN and UBN) cables, with synthetic rubber insulation, prevent current diversion, eliminate conduit and extra fittings and are architecturally harmonious. Type SD is efficiently designed for service drops. Sizes 12 to 2 inclusive, 2 and 3 conductors.

HAZARD PERFORMITE TYPE RH BUILDING WIRE IS SUPER AGING

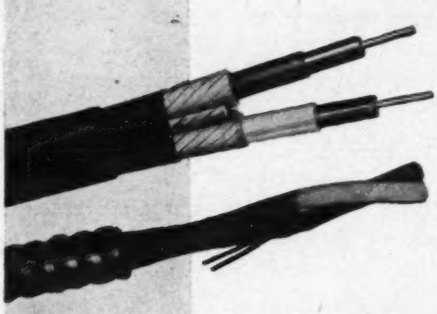
This heat-resistant long-life wire is free stripping and easily installed. Because of its greater carrying capacity, it saves strategic copper. Recommended for branch feeders and general light and interior wiring. All sizes available.

TYPE R HAZACODE WIRE

exceeds all minimum requirements of N.E. Code and is recommended for general interior building wiring; has a sturdy, long lived, flameproof braid covering, and is readily installed.

TYPE RL HAZACODE LEAD ENCASED

is particularly useful now for damp locations while Type RW is unavailable.



HAZARDEX NON-METALLIC SHEATHED CABLE AND HAZARD ARMORED CABLE

for interior wiring are both obtainable. These familiar types of cable are made to exacting Hazard quality standards.

TYPE K FABRIC COVERED CORD—an approved cord for ordinary use.
TYPE KK HAZARD SPIRALWEAVE CORD a portable cable for heavy duty.

Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD

ELECTRICAL WIRES AND CABLES

ARMY E NAVY

3641

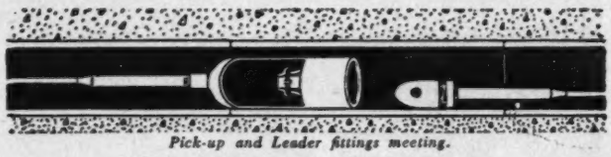
UTILITIES have found that one gang, with Electroline Steel Duct-Rodding Equipment, can make a half-hour job out of one that formerly took two gangs two weeks with old-style equipment!

In consequence, they have made amazing savings in labor cost alone. Add to this lower first cost, the lower handling cost, and longer life . . . then you have their reason for adopting Electroline's speedy, economical Duct-Rodding Equipment.

The construction is simple and trouble-free, yet affords the outstanding advantages of easy, efficient rodding and great durability in service.

You can turn days into minutes, too—by speeding up installation and cutting costs with Electroline Duct-Rodding Equipment. Get full details and prices . . . write for a copy of descriptive Bulletin 939.

Thirty minutes or two weeks ?

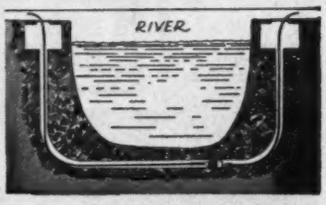


Pick-up and Leader fittings meeting.

Right, Electroline Steel Rodding Equipment feeds easily around the bends.

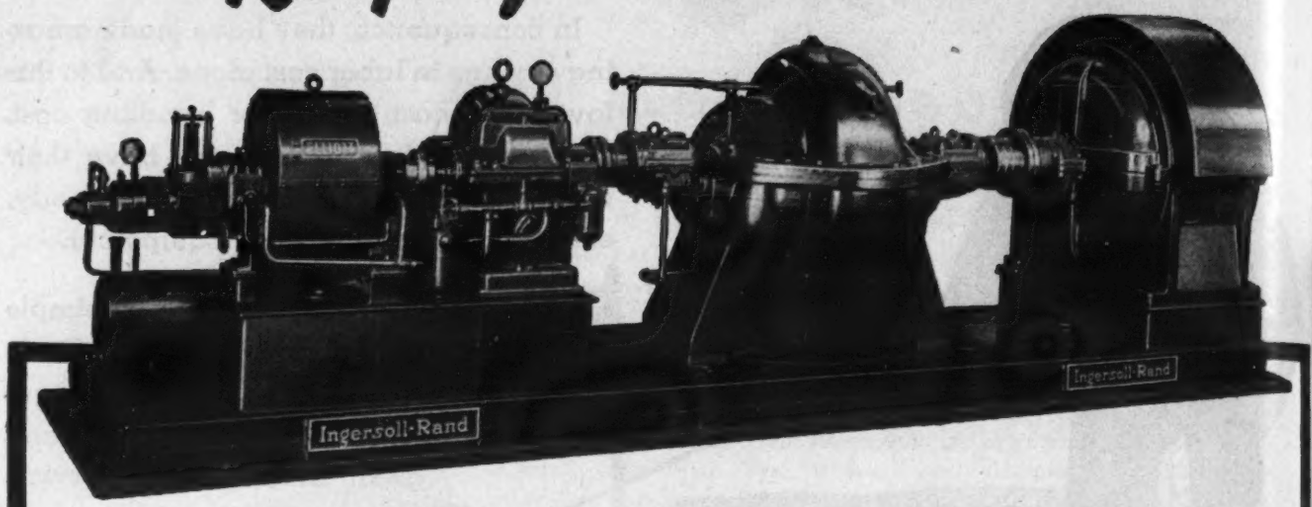
Below, Leader locked in Pick-up for either push or pull.

PATENT APPLIED FOR



Electroline Company

A UNIT WITH "keep-going" reliability!



IT'S A CONDENSER CIRCULATING WATER PUMP...

In the first place, it is normally driven by its perfectly good, reliable motor . . .

But, should electric power fail for any reason, causing the motor speed to drop 5 per cent below normal . . .

The steam turbine end takes over automatically, with no questions asked . . .

So there are *two* reasons why this circulating pump will keep going, regardless. Here's the *third* . . .

Both motor and turbine are Elliott. Which means that both driving units have built into them that extra something to keep them going even under tough conditions. "Performance-plus" is another word for it, and it's a quality that makes quite a few engineers dictate Elliott when they want an auxiliary drive.

The unit pictured above uses a two-speed motor and the turbine is equipped with a variable-speed oil governor, permitting flexibility of operation.

If you want auxiliary drives with the "Keep-going" reliability of an army jeep in a shell-torn desert—talk it over with the Elliott engineers. Reliability is the factor that governs every engineering decision they make.

ELLIOTT COMPANY
JEANNETTE, PA. • RIDGWAY, PA. • SPRINGFIELD, O.
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Q-1111

ARMY (E) NAVY ARMY (E) NAVY

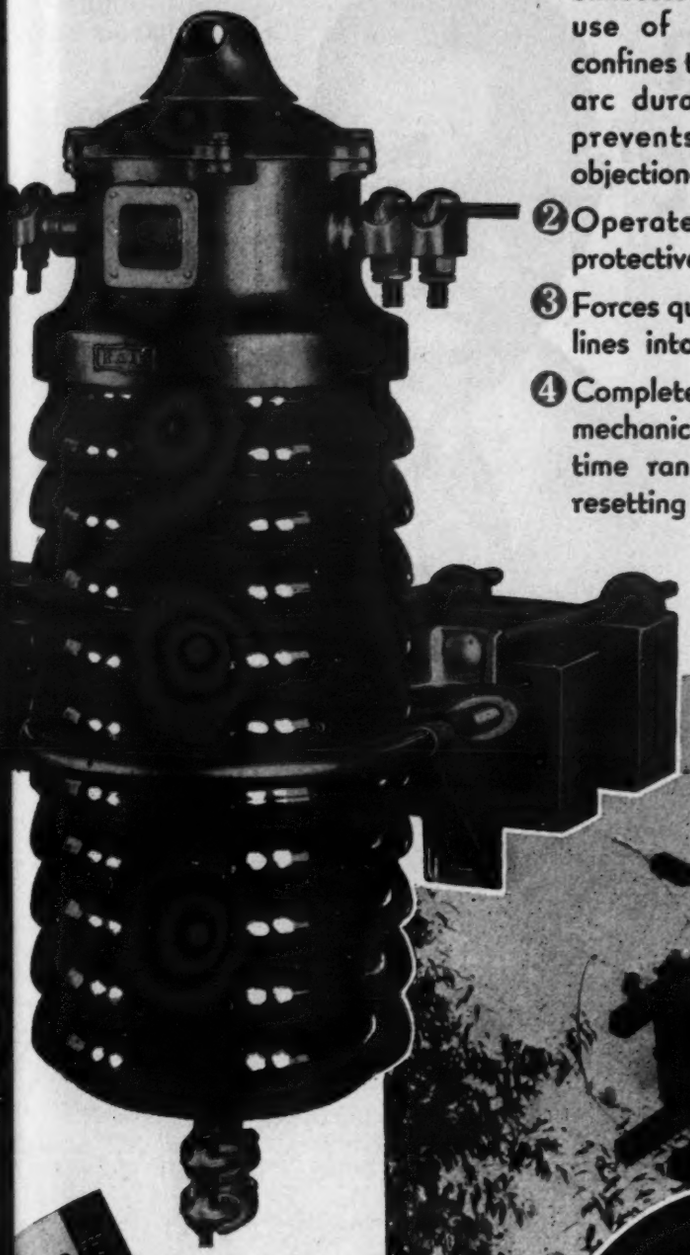
ELLIOTT Company

STEAM TURBINES • GENERATORS • MOTORS
CONDENSERS • FEEDWATER HEATERS AND DEAERATORS • STEAM JET EJECTORS
CENTRIFUGAL BLOWERS • TURBOCHARGERS FOR DIESEL ENGINES • TUBE CLEANERS
STRAINERS • DESUPERHEATERS • FILTERS

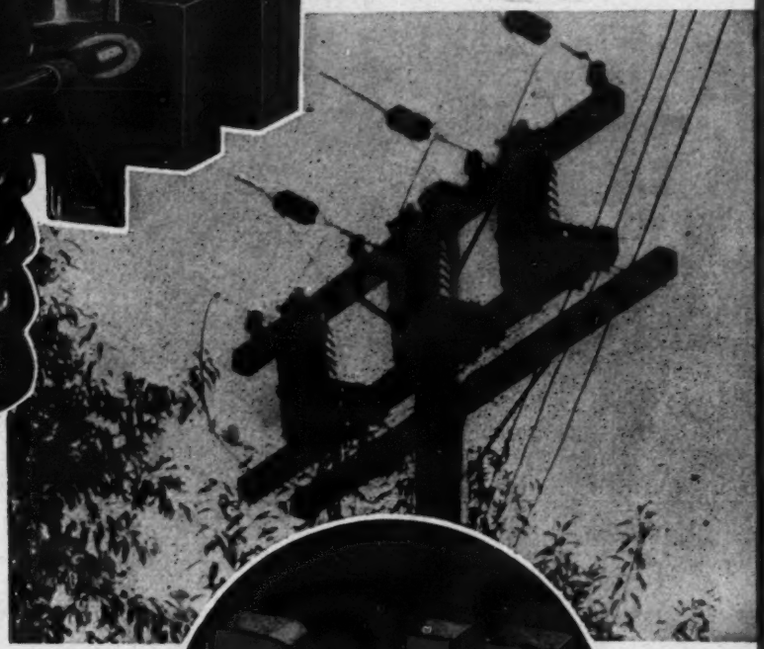
CHECK the FACTS

This half cycle, high speed SHORT CIRCUITER reduces the line voltage to zero during faults — extinguishes the arc, forces quick tripping, saves fuses, thereby improving distribution service.

1. Controlled short circuit — prevents unnecessary blowing of fuses, permits use of more sectionalizing fuses, confines trouble to faulted phase, limits arc duration to one-half cycle, and prevents burned-down, and other objectionable damage to wires.
2. Operates with existing overload protective switchgear.
3. Forces quick tripping—brings "tag end" lines into relayed zones.
4. Completely automatic — adjustable, mechanical timing to cover necessary time range of lock-out period — no resetting necessary.



A typical installation in Pennsylvania where the power company improves distribution service through purposeful controlled short circuit.



VOLTAGE RATINGS - 7.5/12.5 KV.
CURRENT RATINGS - 50-100 or 100-200 Amp.
HANDLES FAULTS - up to 5000 Amps.

For complete information write for Bulletin No. 1382

R&IE

LINE SHORTING CONTACTOR

The Check List

- CONDUCTOR SUPPORTS CLAMPS AND FITTING
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- AIR BREAK SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SECTIONALIZING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

IN CANADA—EASTERN POWER DEVICES LIMITED TORONTO

Then he said to himself

"THEY CAN NEVER BOMB THIS PLACE"

WITH 300 pound vehemence, Reich-Marshal Hermann Goering once impressed the heilers and the heiled in Berlin with this guarantee:

"THEY CAN NEVER BOMB THIS PLACE"

He was not trying to mislead.

Give him credit . . . he had figured it out as any business man would:

(a) He figured what his competition had

(b) He figured what he had

The answer was simple arithmetic . . . then, departing from arithmetic

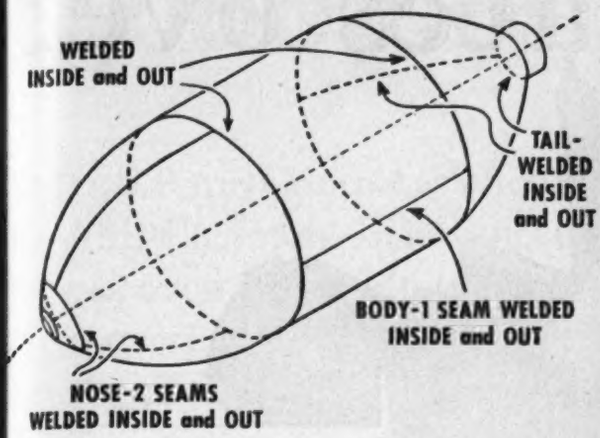
(c) He *estimated* how long it would take his competition to catch up. On *that* he went completely crackpot—unalterably haywire—irretrievably "losing his market" as they say.

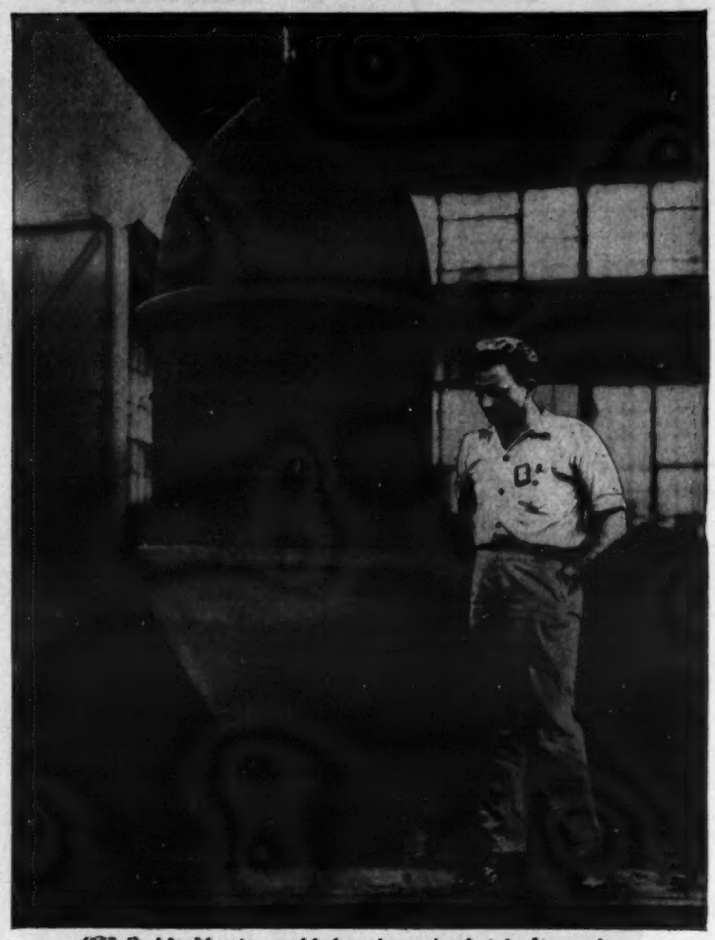
And that just proves again that NO ONE can estimate the regular step-ups in output made possible by enthused producers

. . . having recourse to a flexible production technique

. . . that keeps improving regularly.

Listen Hermann, Never say NEVER!





4000-lb. blockbuster, welded as shown in sketch. Its production has been increased by improved arc welding technique.

You're too cagey a rascal *not* to have figured that *recourse* to Arc Welding would speed America's war output. So you estimated that step up at, say, 25%.

But as it turned out, production of Berlin-busters, ships, planes, tanks and guns was stepped up another 25% and then other 25%'s by added recourses applied AFTER your "NO BOMBING" assurance.

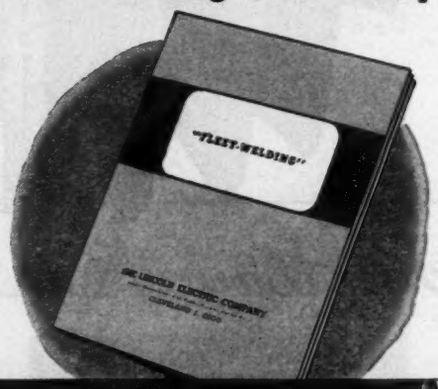
And now, the knockout blow

. . . Lincoln introduces the New "Fleet-Welding" Technique

recourse to which gives additional step-ups in welding production of 25% . . . 50% . . . 100% . . . and more.

This arc welding technique, developed by Lincoln Engineers, uses *arc force* to get deeper penetration and higher welding speed for all types of joints in mild steel plate, shapes and sheet. Procedure manual with full details will be sent free to engineers and production supervisors.

There is a Lincoln Engineer near-by to assist you in applying the "Fleet-welding" Technique to war production and postwar planning. Call him or write:



THE LINCOLN ELECTRIC COMPANY • Cleveland 1, Ohio

America's greatest natural **recourse**

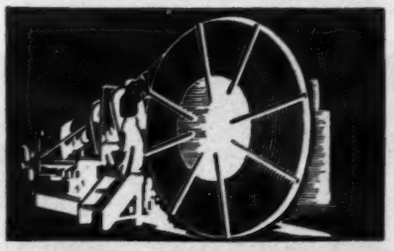
ARC WELDING

Why Allis-Chalmers now Regulates over

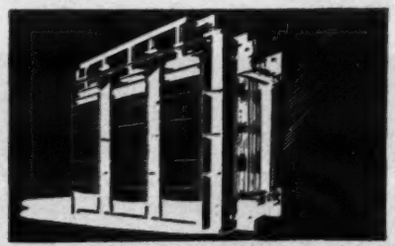
ALLIS-CHALMERS Load Ratio Control provides dependable, economical voltage regulation for high-power systems. It enables you to quickly and conveniently change power output *under load* to meet fluctuating power demands.

Contact our nearby district office for complete information on these modern, precision-built units. Or write direct to ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

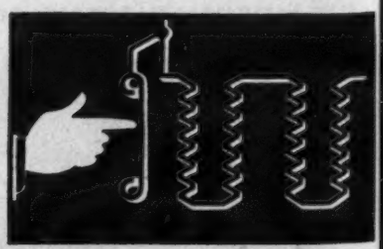
Wise Buy: ALLIS-CHALMERS POWER



CIRCULAR COIL is the ideal design electrically — is strongest mechanically. Wound with uniform tension. Has heavy turn-to-turn insulation, brazed connections.



SHELL TYPE CONSTRUCTION permits solid insulation between coils without impeding oil circulation. Results: increased cooling, longer life, lower maintenance.



ELECTROSTATIC PLATE absorbs shock of high impulse voltage, distributes stress evenly . . . thus safeguards transformer life, reduces possibility of unexpected breakdown.

Load Ratio Control

8,000,000 kva . . .

★ Load Ratio Control as offered by Allis-Chalmers is advanced, time-proven . . . result of years of pioneering in the field of voltage regulation.

★ Non-burning Elkonite RS-1045 is used to provide heavy-duty, long-life contacts.

★ These sturdy Allis-Chalmers contacts of special metal alloy practically eliminate wear and unexpected outage—cut routine servicing to minimum.

★ Full-size circuit breakers interrupt current for tap changes on large units — give shockless contact movement. Motor-operated tank hoist on breaker housing provides easy inspection.

★ Exclusive A-C "Feather-Touch" Control, with voltage integration, provides best overall voltage characteristics. Available for automatic regulation.

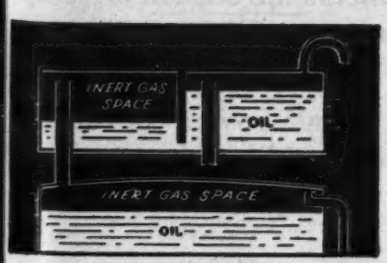
★ Entire unit is precision-machined, ruggedly built . . . for long, efficient service.

★ When you buy Load Ratio Control from Allis-Chalmers, you buy from a company with broad experience in *all* phases of electrical engineering.

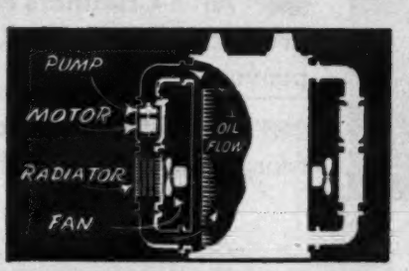
A 1690

♪ *Tune in the Boston Symphony, Blue Network, every Saturday at 8:30 pm, EWT.*

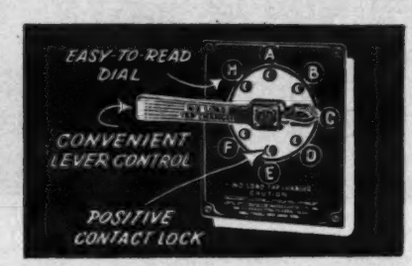
TRANSFORMERS *with Load Ratio Control*



OIL-SEALED INERT GAS EQUIPMENT provides low pressure cushion over insulating oil to allow for expansion. It's simple, foolproof . . . has no moving parts, no delicate valves.

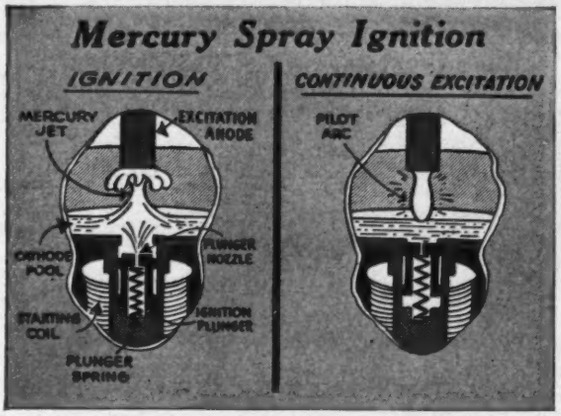


ELECTRO-COOLER for economical, practical forced-oil cooling. Steps up load capacity by accelerating oil-cooling process. A self contained unit requiring minimum maintenance.



NO-LOAD TAP CHANGER operates from side of tank, away from high voltage lines—is convenient and safe. Operating mechanism is simple, sturdy; contacts are heavy-duty.

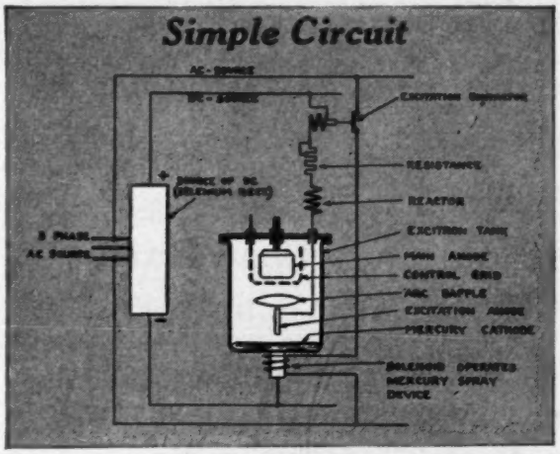
NO OTHER SINGLE ANODE RECTIFIER IS CONTINUOUSLY PRIMED!



☛ Allis-Chalmers' Excitron is the only mercury arc rectifier which gives you the advantages of "continuous excitation".

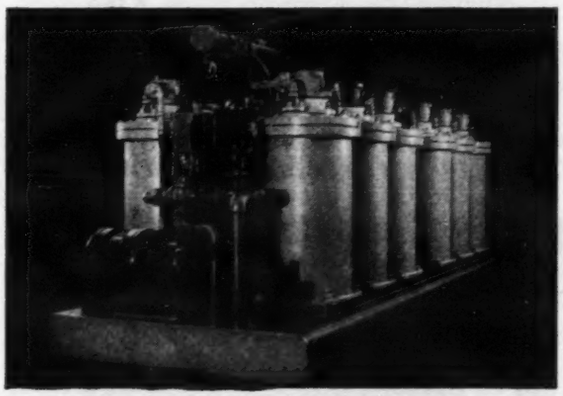
☛ That means with Excitron there are no ignition impulses to be synchronized with main anode voltage. Tubes don't require re-ignition at start of each positive half-cycle.

☛ Solenoid mercury-spray device creates small d-c pilot arc which keeps tube primed for firing while rectifier is in service.



☛ Excitron is the only rectifier with a simple excitation circuit. Elements of circuit are familiar, commonly used. No "tuning" is necessary to maintain proper wave shape. Once adjusted and tested at factory, no further adjustment is required in the field.

☛ Only Excitron takes direct current from a 3-phase source for excitation. Stability of excitation cannot be affected by average single phase dips in the a-c system voltage.



☛ In Excitron, each anode has its own vacuum vessel and mercury cathode. That means compact construction, short arc, small arc-drop, high operating efficiency.

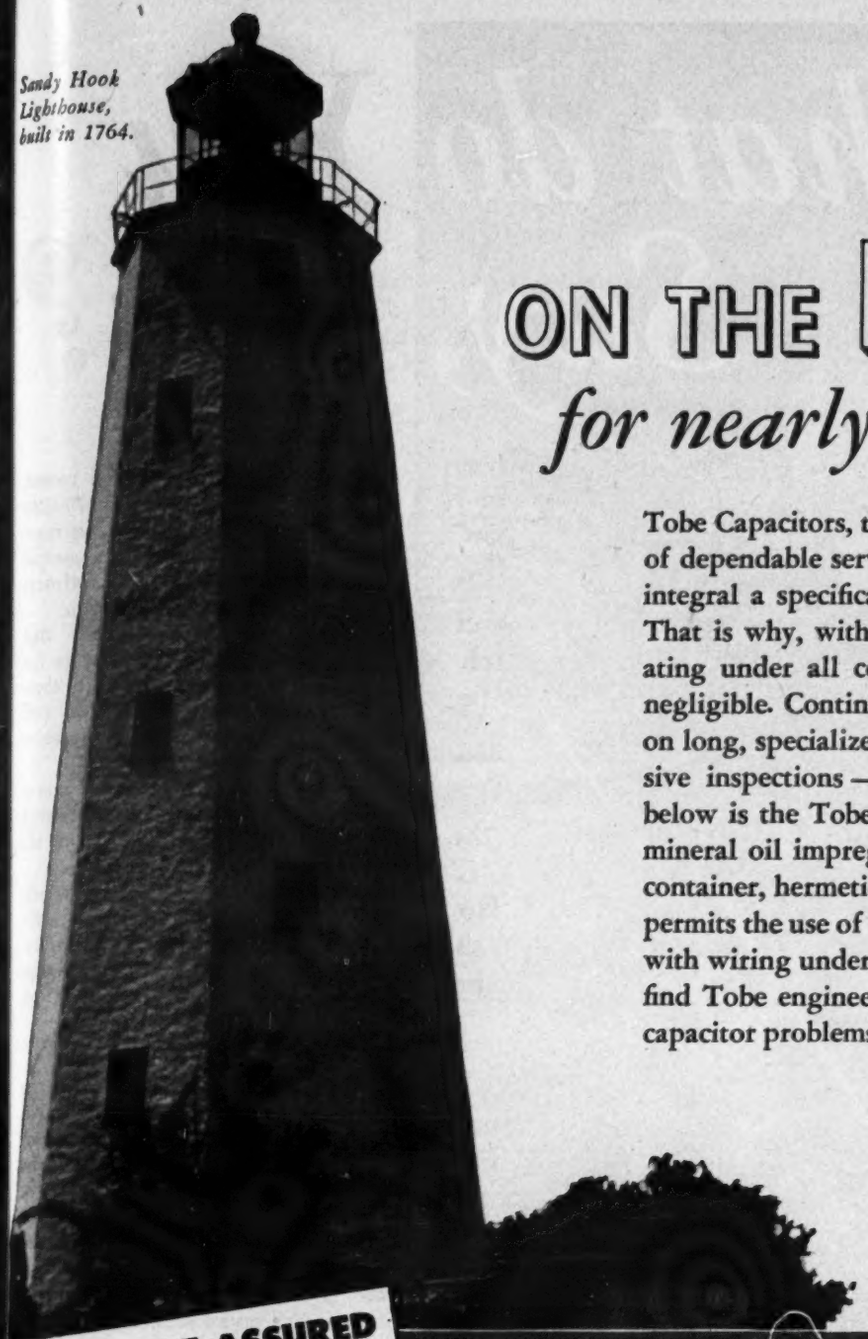
☛ Allis-Chalmers engineers introduced mercury arc rectifiers to U. S. industry. Excitron is time-proven.

☛ Consider Excitron for all power conversion from 250 v. Allis-Chalmers, Milwaukee 1, Wis.

A 1718

♪ *Tune in the Boston Symphony, Blue Network, every Saturday at 8:30 pm, EWT.*

ALLIS-CHALMERS EXCITRON MERCURY ARC RECTIFIERS



Sandy Hook Lighthouse, built in 1764.

ON THE BEAM-
for nearly two centuries

Tobe Capacitors, too, are "on the beam"—giving years of dependable service . . . for, at Tobe, *long life* is as integral a specification as the dimensions themselves. That is why, with millions of Tobe Capacitors operating under all conditions, "returns" are practically negligible. Continuation of this enviable record rests on long, specialized manufacturing experience—intensive inspections—and constant research. Illustrated below is the Tobe OM-Capacitor. This capacitor is a mineral oil impregnated unit in a streamlined drawn container, hermetically sealed. The hold-down bracket permits the use of either inverted or upright terminals, with wiring underneath or on top of chassis. You will find Tobe engineers ready to cooperate on your own capacitor problems. Why not inquire now?

TOBE DEUTSCHMANN CORP. TOBE CANTON · MASSACHUSETTS

LONG LIFE ASSURED

This new separate mounting is stronger and helps prevent leaks caused by breaks in can. This outstanding Tobe design takes the minimum amount of space.

SPECIFICATIONS

OM-CAPACITORS

TYPE	OM-*
RATINGS	.05 to 2.0 mfd. 600 V. D. C.
	.05 mfd. to 1.0 mfd. 1,000 V. D. C.
STANDARD CAPACITY TOLERANCE	20%**
TEST VOLTAGE	Twice D. C. rating
GROUND TEST	2,500 Volts D. C.
OPERATING TEMPERATURE	-55° F to 185° F
SHUNT RESISTANCE	
	.05 to 0.1 mfd. 20,000 megohms
	.25 to 0.5 mfd. 12,000 megohms
	1.0 to 2.0 mfd. 12,000 megohms
POWER FACTOR	
	At 1,000 cycles—.002 to .005
CONTAINER SIZE	
	Width ⅝", length 1 5/16", height 2¼"
MOUNTING HOLE CENTERS	1½"

MIDGET OM-CAPACITORS

TYPE	OMM-*
RATINGS	.05, .1 and
	2 x .05 600 V. D. C.
	.05 x .1 1000 V. D. C.
STANDARD CAPACITY TOLERANCE	20%**
GROUND TEST	2,500 V. D. C.
OPERATING TEMPERATURES	-55° F to 185° F
SHUNT RESISTANCE	20,000 megohms
POWER FACTOR	At 1,000 cycles—.0075
CONTAINER SIZE	
	Width ⅝", length 1 5/16", height 1 11/64"
MOUNTING HOLE CENTERS	1½"

*Data sheets showing complete code number for units having a specific capacitance value and voltage rating available on request. **Other tolerances available.

A SMALL PART IN VICTORY TODAY...A BIG PART IN INDUSTRY TOMORROW

What do You Say, Doc?

THE "DOCTOR"—McGarvey Eddleman of Allis-Chalmers Norwood Works—is taking a temperature reading during the heat-run test. It's just one precaution that helps Allis-Chalmers build consistently great motors.

NO—THAT'S NOT a sick motor. Actually it's a very *healthy* one. But that's something we must know — through generous sample testing — before Allis-Chalmers motors can tackle jobs for you.

Part of the "physical exam" that motor at the left must pass is the heat run test. Bristling with thermometers, the motor runs at full load — and speed and temperature are recorded for every hour.

Five or six hours can tell you a lot about a motor's characteristics —but it takes more like five or six *years* to tell you its *character.*

And it's the test of time in which Allis-Chalmers motors have established that they are *great* motors. That's why you hear so many engineers say: "You can depend on Allis-Chalmers Motors!"

• • •

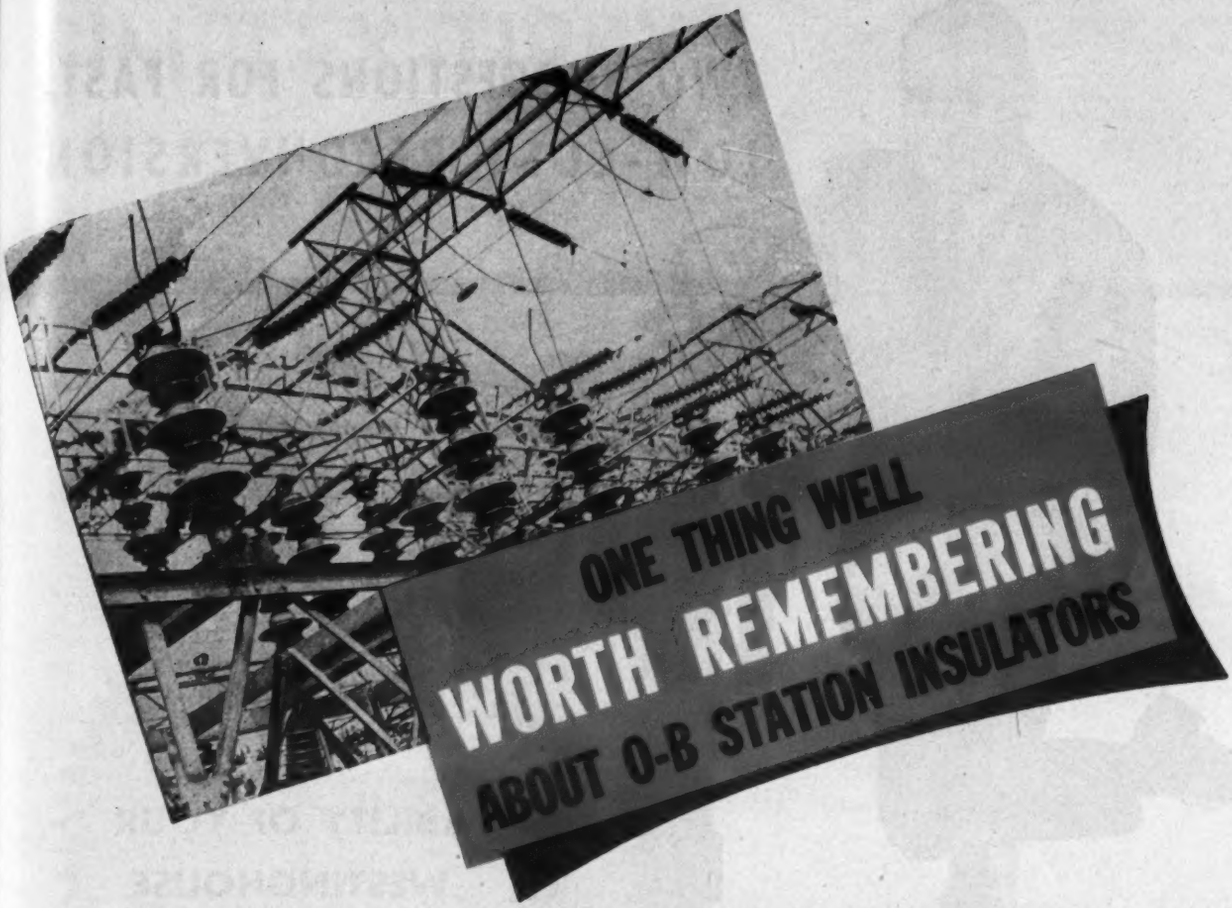
If you could meet and talk with the men who build Allis-Chalmers motors, you might be surprised to learn how keenly they are aware of the big *personal* stake they have in every motor they build for you.

They know that factory tests to fully pre-determine how well a motor is built *just don't exist;* that there's still no substitute for responsible craftsmanship.

And they know that when they build great motors for you they're making *friends*—and that no company and its workers can have too many of them. ALLIS-CHALMERS, MILWAUKEE 1, WIS. A 1726

♪ *Tune in the Boston Symphony, Blue Network, Saturday at 8:30 pm, EWT.*

YOU CAN DEPEND ON ALLIS-CHALMERS MOTORS



Remember just this one thing about station insulators: You can specify their size, their shape and other dimension details. You can specify their mechanical strength. You can specify their electrical characteristics. You can specify tests for predicted life. From this, you might assume they are all alike, but they're not, simply because you can't specify the knowledge or the ability of the man who makes them, nor can you specify how diligently he shall apply that knowledge. Yet, it is knowing what to do and being willing to do it that makes all the difference a few years hence. No tests on a "brand new" station insulator will tell you whether it will still be on the job twenty or thirty years from now--a common service record with O-B--and, after all, that is what you really want to know. You can be sure of it, however, by specifying O-B, and we can back this claim with the longest service records in the industry.

3483-H

Ohio Brass

MANSFIELD, OHIO, U. S. A.

CANADIAN OHIO BRASS COMPANY, LTD., NIAGARA FALLS, ONTARIO

TWO SUGGESTIONS FOR FAST, LOW-COST RECONVERSION

USE THIS BOOK . . .

to save time in selection . . .
ordering . . . application

The Westinghouse Distribution Apparatus Digest is distributed at regular intervals by Westinghouse distributors. It includes complete specification and application data on porcelain insulators, lightning arresters, cutouts, power fuses, transformers, capacitors, voltage regulators, meters, instruments, circuit breakers and lighting.

Ask your Westinghouse distributor for a copy . . . he'll be glad to supply you and put you on his mailing list for future issues. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.

Your Westinghouse distributor offers two important aids in meeting sudden load shifts on war-loaded power lines.

First: Westinghouse "one-package" CSP Distribution Transformers . . . easily movable as a unit when load centers shift.

Second: The distributor's own "how-to-do-it" ability . . . knowledge drawn from Westinghouse transformer headquarters and experience gained in similar applications for many other customers.

CSP transformers are completely self-protecting against lightning, short circuits and dangerous overloads. Every part is co-ordinated and built-in, making installation simple . . . relocation quick and easy, with just ONE unit to move instead of many pieces of conventional equipment.

Your Westinghouse distributor handles CSP distribution transformers in ratings up to 50 kv-a to meet any single-phase 60 cycle requirement. Call on him for prompt, competent help and recommendations.

J-90511

SEE YOUR WESTINGHOUSE DISTRIBUTOR *FIRST!*

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

SIMPLEX-TIREX

flexible electric cords and cables

with

Selenium Rubber Armor

for

Long Service
Economical Operation
Dependable Performance
All-round Satisfaction

Prewar Simplex-TIREX cords and cables were outstanding because of their tough, flexible outer covering or sheath, a selenium-cured rubber compound which was almost wearproof and earned the name "Selenium Rubber Armor" by the way it stood up under the use and abuse of hard service.

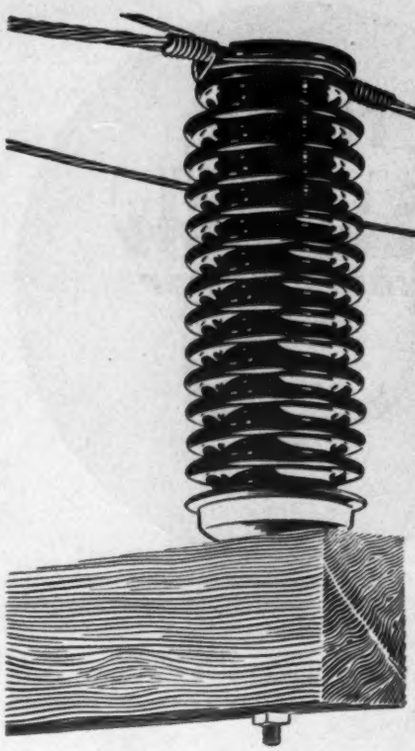
The protecting outer covering of TIREX cords and cables continues to be a "selenium rubber armor," fully deserving the name, although synthetic rubber has replaced natural rubber.

Extreme toughness and abrasion resistance can be obtained by curing natural rubber compounds with selenium. Similar results are being obtained with synthetic rubber. Selenium curing is used exclusively by us to produce cords and cables that you can depend upon for long, trouble-free performance.

When you buy cords and cables for portable electric tools or for mobile equipment that depend upon electric cables for power, you naturally want maximum value for the price you pay. You want long life and dependable, economical performance. You cannot do better than use Simplex-TIREX cords and cables with their "selenium cured, synthetic rubber armor."

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

Simplex WIRES and CABLES

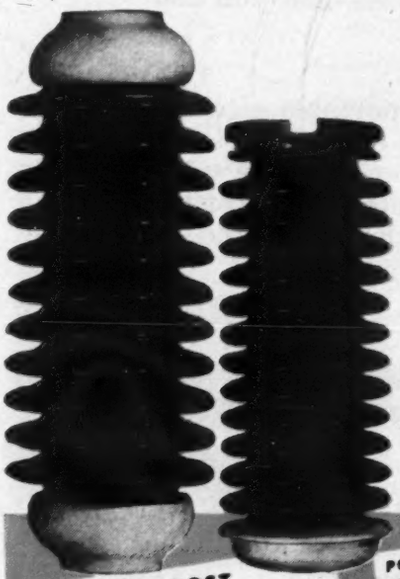


WARTIME CONSTRUCTION

need not be "TEMPORARY CONSTRUCTION"

TRANSMISSION LINES ON WOOD POLES AND LAPP LINE POSTS ARE LONG-LIFE, LOW-TROUBLE LINES . . . . . THAT GO UP FAST AND USE A MINIMUM OF MATERIAL

• On a cost-per-year basis, transmission line construction on wood poles with Lapp Line Posts is most practical and economical. And today, if load demands make it necessary for you to build a new line under war-emergency restrictions, you'll find this same construction will require least in critical materials, least in man power. The extra height of Lapp Line Posts will give your line better clearance, or even in some cases permit use of shorter poles. Coordinate necessity measures with your long-time planning and build low-cost long-service lines—on Lapp Line Posts.



LAPP LINE POST and STATION POSTS on your system offer . .

POWER ARCOVER. *Flashover and leakage distances are not appreciably lowered by damage —even loss of several petticoats.*

NO PUNCTURE. *Puncture path in Lapp Post design is as great as flashover path. Insulator will flash over rather than puncture.*

NO CRACKING. *One piece post body, not subject to bursting from tension strains created by thermal changes in nested parts.*

RADIO INTERFERENCE. *By virtue of design factors alone, radio interference is permanently prevented at rated neutral voltage.*

NO CLEANING. *Fog-type design preserves uniform leakage path, prevents leakage flashover, makes the unit "self-cleaning."*

MECHANICAL RUGGEDNESS. *Stones or bullets deflect off, or rupture petticoats, leaving post body intact and insulator secure.*

Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, N. Y.

CROCKER-WHEELER MOTORS for ALL INDUSTRY

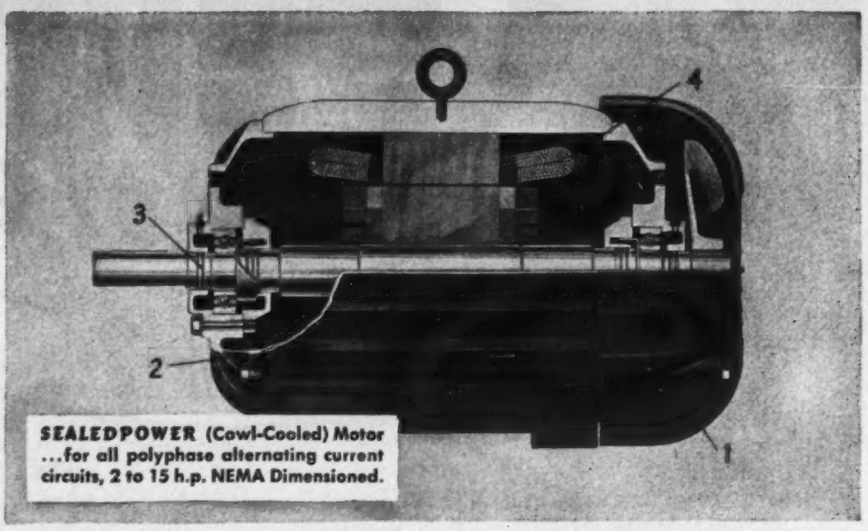
FEATURES

1. Totally Enclosed Cowl-Cooled type minimizes fire hazard, resists corrosion. Protects against acid or alkali fumes, splashing or dripping corrosive liquids, air-borne moisture, steam, corrosive gases, conducting dusts, metallic chips, lint, etc.

2. Fin Type single shell construction, with all surfaces exposed and a readily removable fan shroud, gives non-clog ventilation. Easy to clean...foreign matter passes over the surfaces of and not through the motor.

3. Patented GROOVSEAL antifriction bearings—no greasing needed for at least a year—minimizes maintenance. Seal permits use of softer grease, for better lubrication and longer bearing life. Water-tight—Dust-tight—Air-tight.

4. Vacuum Impregnation with high grade insulating varnish seals out foreign matter and moisture from each individual coil...makes windings a homogenous mass...reduces hot-spot temperature and lengthens insulation life. Adherence of varnish prevents vibration of wires inside or outside of slot.



SEALEDPOWER (Cowl-Cooled) Motor ...for all polyphase alternating current circuits, 2 to 15 h.p. NEMA Dimensioned.

SEALEDPOWER...Industry's Most Trouble-Free Motor

because...

YOU CAN DEPEND on a Crocker-Wheeler field engineer to recommend the power equipment *you need*. Behind him is *56 years* of our company's experience...*56 years* of continuously developing facilities and skills *exclusively* in the power field.

Crocker-Wheeler, one of the leading companies in the field, specializes SOLELY in the design manufacture and application of electric power equipment.

As power SPECIALISTS, Crocker-Wheeler field engineers know the power needs of your industry—of your particular production processes. Call in one of our experienced engineers for specific advice on motors, generators, control and couplings . . . no obligation.

JOSHUA HENDY IRON WORKS

CROCKER-WHEELER DIVISION

ESTABLISHED 1856

AMPERE, NEW JERSEY

Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • WASHINGTON • LOS ANGELES

Geon

Vinyl Resins & Plastics

Versatile synthetic materials offered for

INSULATION AND SHEATHING OF ELECTRICAL WIRE AND CABLE

FROM GEON resins may be made a wide variety of thermoplastic elastomers, possessing unusual electrical and mechanical properties. These materials can be extruded, pressure or injection molded, calendered, or cast into sheet and film.

Here are the specifications and properties of a representative formulation of GEON for cable insulation, in this instance, GEON 2046:

Dielectric strength	800 volts per mil
Insulation resistance	6.0 x 10^{15} ohm-cm @ 15.5° C.
Dielectric constant	6.0 @ 15.5° C.
Power factor	.09 @ 15.5° C.
Chemical resistance	Outstanding
Flame resistance	Will not support combustion
Abrasion resistance	Excellent
Air and ozone resistance	Excellent
Moisture absorption	Comparable to best grades of rubber
Tensile strength	2500 p.s.i.
Elongation	300%
Oil resistance	Excellent
Aging and light resistance	Excellent
Color range	14 Standard NEMA colors

GEON insulation and sheathing can be extruded directly onto the wire or formed into slip-on tubing. GEON film or GEON-treated materials can be made into tape for very fine insulation. GEON can be molded into plugs, connectors, etc.

By varying the type of GEON resins and plasticizers a great number of different combinations of properties may be obtained. Or, GEON, properly blended with certain synthetic rubbers, will impart to the rubber characteristics otherwise unobtainable.

The complete GEON story cannot be told in this limited space. But our research staff and laboratory facilities are available to help you work out any special problems or applications. *For answers to your questions write*

Dept. C-2 CHEMICAL DIVISION
The B. F. Goodrich Company
ROSE BUILDING E. NINTH & PROSPECT CLEVELAND 15, OHIO

GEON is available to industrial users subject to allocation under General Preference Order M-10. Limited quantities can be had for experiment.

Prof. F. J. Vogel, Illinois Institute of Technology in discussing deterioration of insulation in oil immersed transformers said that it is difficult to say what level of acidity is dangerous in transformer oils. Maintenance and the use of judgment, he said, seem to be the only way to prevent trouble with acid oil. F. J. Pohnan, Commonwealth Edison Co. found it "strange" that deterioration effect of acid on solid insulation of transformers has been ignored in the past and attention restricted to the effect of acid on the oil alone. [illegible] he pointed out, [illegible]

"ELECTRICAL WORLD"
April 22nd, 1944

To keep

INSULATING OIL

free of

MOISTURE—AIR

and harmful ACIDS

The BUCKEYE "HYDROVOLIFIER"

1. A PORTABLE, COMPACT MACHINE Permits servicing of transformers in place without service interruptions.

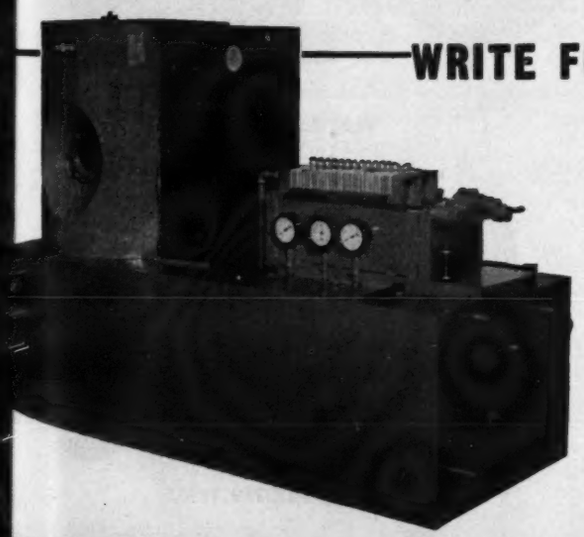
2. LOW OPERATING COSTS On larger models less than one cent per gallon.

3. A CONTINUOUS PROCESS Oil from transformer flows through Hydrovolifier is returned to transformer in a continuous circuit.

4. SIMPLE, AUTOMATIC OPERATION Only three connections are made in the inlet and outlet lines and power circuit. Temperatures and pressures are automatically controlled.

5. LARGE CAPACITY Three standard sizes—100 gal. per hr.—300 gal. per hr.—500 gal. per hour. Oil serviced in a single pass through the apparatus.

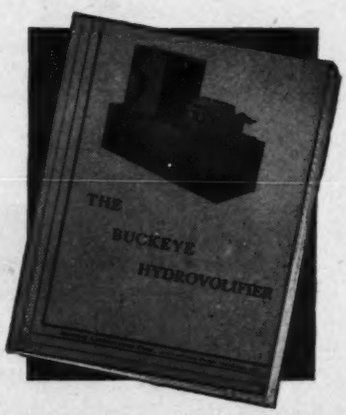
6. A CLOSED SYSTEM In the Buckeye Process oil is treated at low temperature under high vacuum. No air comes in contact with oil during processing.



WRITE FOR HYDROVOLIFIER BULLETIN

• Contains information on factors affecting performance of insulating oils—how the Hydrovolifier works; design and construction of the apparatus. Write for your copy today.

★



BUCKEYE LABORATORIES CORP.

1965 EAST 66TH STREET . . . CLEVELAND 3, OHIO

OPEN WIRING

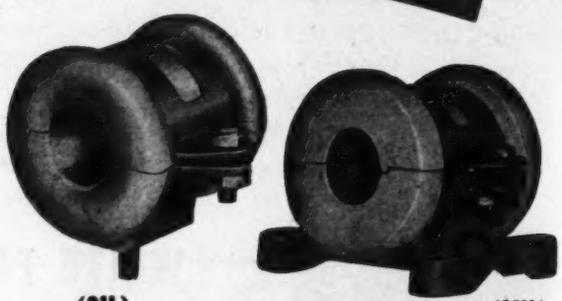
A BIG ADVANTAGE FOR MAKING QUICK, DEPENDABLE, FLEXIBLE INSTALLATIONS . .

★ This method of rigidly supporting cables is simple as can be. It affords extreme flexibility, safety, and neatness. There is much less cost to making an installation and *you save delays in securing critical materials* such as where conduit or duct is used. You can plan on installing these cables immediately if you plan on using "THREE E" Clamp Insulator Supports.

A complete line of multiple conductor supports in triangular configuration are available for single bolt and double bolt flat mounting, pipe mounting and H and I beam mountings. Multiple conductor supports containing any desired number of conductors can be supplied grouped on channel bases. Write for your copy of Bulletin No. 201.

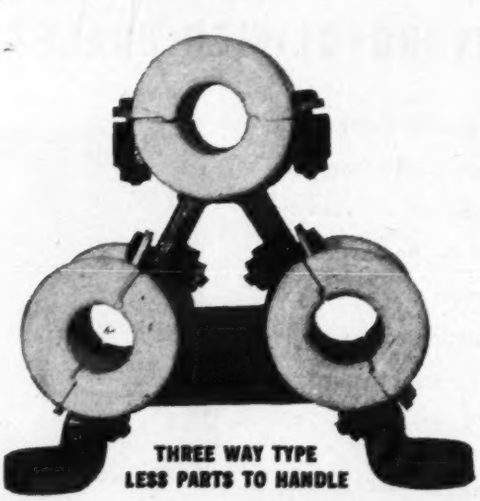
The supports are built and recommended for either AC or DC service.

"Three E" CLAMP INSULATOR SUPPORTS
Single and Multiple Types



(CIL) (MIL)

FLAT MOUNTING TYPES

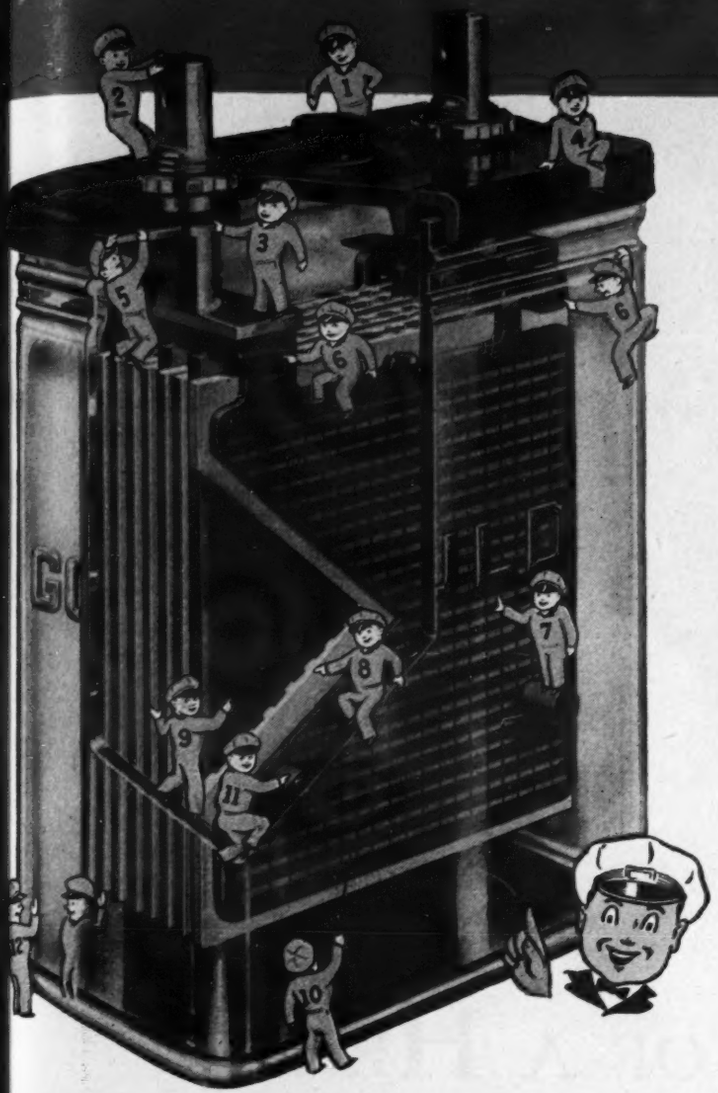


THREE WAY TYPE
LESS PARTS TO HANDLE

(CIL) (MIL)

PIPE MOUNTING TYPES

ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK ILLINOIS



EATURES THAT MAKE PERFECTION IN THE GOULD PLANTÉ

r many years Gould has been testing and perfecting the design the Gould Plante battery, while still retaining the basic principle the deeply ribbed pure lead positive plate.

me improvements have been small, some large. Each, however, s proved itself in actual operation. Each has added something to e battery's efficiency, has made it a better product . . . better for e user from all standpoints.

day the Gould Plante is first choice where the reliability of standby control operation is of major importance.

l all the facts by writing Dept. 127 for Bulletin 1000 on Gould Sealed-In-Glass Batteries for Stationary Applications.

1 HARD RUBBER VENT: Readily removable for flushing and checking.

2 TERMINAL POST: Exceptionally rugged, to guard against mechanical failure and to permit ample carrying capacity. Multiple posts used on larger cells.

3 TERMINAL POST SEAL: Acid resisting soft rubber gasket held in compression by a lead alloy nut. Assures an absolutely leak-proof seal.

4 HARD RUBBER COVER: Acid resisting, of high mechanical strength, provided with deep sealing groove into which is poured a sealing compound of exceptional elasticity and adhesion making an acid tight seal.

5 ELEMENT SUPPORT: Horizontal antimonial lead projection cast as integral part of terminal posts, resting on top edges of glass jar, transmits entire support to jar walls. Distortion, warping, and cover strain are eliminated.

6 GOULD DUAL SUSPENSION: The far sides of both positive and negative groups are carried by hard rubber channels which, in turn, are supported from the crossbar and plate assembly of the groups of opposite polarity. This is *Gould's Exclusive Dual Suspension*, a construction which completely eliminates misalignment or breakage of cell parts.

7 NEGATIVE PLATE: Antimonial lead grid of interlocking bar design. The negative active material is a highly porous metallic oxide compounded to special Gould formulas. It assures close eleotrical contact, low internal resistance, and high sustained capacity in balance with the Plante positive unit.

8 WOOD SEPARATORS: Highest quality Port Orford cedar separators treated to remove injurious compounds and deeply grooved to permit the free circulation of the electrolyte.

9 POSITIVE PLATE: Made from single piece of pure lead by Gould's famous spun plate and "chemically pure" processes.

10 BARRICADED OUTSIDE NEGATIVE PLATE: Heavy cast antimonial lead negative grid, outer surface having alternate horizontal narrow openings and broad solid sections. Prevents overexpansion and loss of negative active material.

11 SOFT RUBBER BUMPERS: Inserted through cylindrical openings in outside negative plates; center and cushion element in jar.

12 GLASS JAR: Machine blown, clear glass, carefully annealed to remove strains, folds, and distortion. Unaffected by normal temperature changes.

FOR EXCELLENCE IN STORAGE BATTERY PRODUCTION AT DEPEW PLANT.

GOULD STORAGE BATTERY CORPORATION, Depew, N. Y.

Factories: Atlanta • Chicago • Dallas Depew • Leavenworth • Los Angeles North Bergen • Rock Island • St. Paul Sioux City • Zanesville

— Buy War Bonds —

GOULD

Since 1898 THE BATTERY PICKED BY ENGINEERS

PORTRAIT OF A HERO
...handle with care!

Many a wounded hero will come home well and strong again, thanks to a thin sheet of film...

Thanks to the miracle of the X-Ray . . .

And thanks to air conditioning and refrigeration which help make the miracle possible! *Air conditioning* supplies clean, filtered air—with accurate regulation of both temperature and humidity—in plants where X-Ray film is made, in army hospitals where it is used. *Refrigeration* cools the solutions used in processing the film.

Out of such wartime applications, General Electric is evolving new techniques, finer equipment for conditioning temperature and humidity. When equipment again is available for peacetime commercial and industrial uses, it will be vastly improved—more compact, more efficient, more flexible than ever before!

Now . . . we'll be glad to put your name down for *earliest available* data on postwar air conditioning and refrigeration equipment. Write: *General Electric Co., Air Conditioning and Commercial Refrigeration Divisions, Section 426, Bloomfield, N. J.*

☆ BUY WAR BONDS ☆

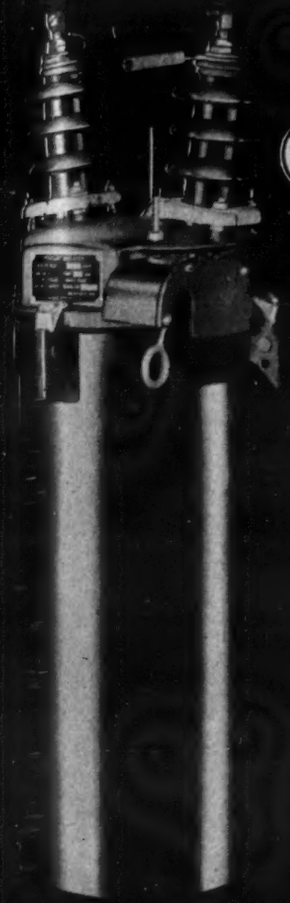
Air Conditioning by

GENERAL ELECTRIC

Hear the General Electric Radio Programs: The "G-E ALL-GIRL ORCHESTRA," Sundays 10 P. M., EWT, NBC..."THE WORLD TODAY" News, Every Weekday, 6:45 P. M., EWT,

KYLE OIL CIRCUIT BREAKERS

Are Easy to Handle • Easy to Install • Easy to Maintain



RATINGS OF
KYLE CIRCUIT BREAKER

BECAUSE Kyle Oil Circuit Breakers make use of standard transformer construction, are held in place by standard transformer mountings, are serviced with standard transformer tools, their installation on your lines is no problem at all.

With no terminal in the bottom of the tank . . . an important safety factor . . . the Kyle Circuit Breaker stands on its own base in the storeroom and is easily handled in your service truck. The all metal tank gives a ruggedness that makes careful handling unnecessary.

Kyle Oil Circuit Breakers are thoroughly tested and inspected at the factory. They are delivered ready to use. Because the bushings at the top are the only external live parts, the breaker can be safely mounted any place on the pole . . . in fact, direct pole mounting for single phase installation is recommended. If crossarm mounting is desired, the A.I.E.E.-N.E.M.A. standard transformer crossarm hanger may be used.

Typical single and three phase installations are illustrated. The breaker is connected in series with the phase wire, with the terminal marked "line" on the course of power. A grounding lug is provided at the bottom of the tank.

Servicing of the breaker is made easy by the fact that the entire assembly is removed from the breaker case as a unit.

When you combine these important installation and service features with the fact that Kyle Oil Circuit Breakers, with their dependable hydraulic timing, can be counted on for years of reliable service, it is not hard to understand the big swing to Kyle in these days when manpower is at a premium.

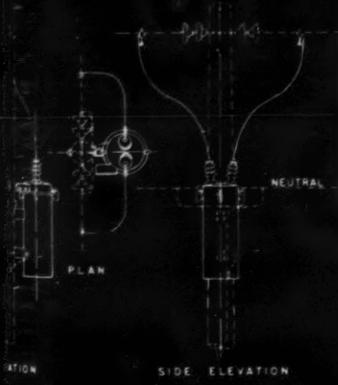
KYLE OIL CIRCUIT BREAKERS REQUIRE LITTLE MAINTENANCE

Kyle Oil Circuit Breakers will give many months of automatic protection to your lines with a minimum of attention.

In normal operation, maintenance may be limited to six months periods, or after 75 operations. At such intervals it is merely necessary to check the oil level . . . float gauge is located on the cover; test the dielectric strength of the oil; check contacts for pitting and burning.

PICAL THREE PHASE INSTALLATION

ICAL SINGLE PHASE INSTALLATION

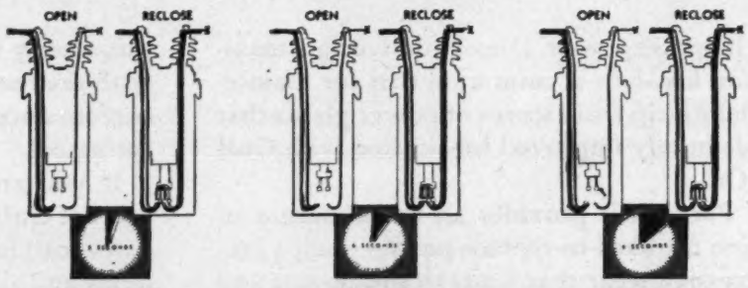


HOW THE KYLE OIL CIRCUIT BREAKER OPERATES

The Kyle Oil Circuit Breaker is so designed that each opening shot is fast and each closing requires an interval of three seconds.

On temporary faults the breaker will operate one, two or three times as may be required, resetting itself for a complete cycle of operations, but will lock out on the fourth operation should the fault be permanent.

When the fault condition on the line is corrected the breaker can be manually reclosed by raising the handle to the up position.



3 SECONDS 6 SECONDS 9 SECONDS

KYLE CORPORATION

SOUTH MILWAUKEE, WISCONSIN

Diesel operating records reflect better lubrication with Gulf Parvis Oil—

TO help keep your Diesels delivering maximum kw.-hrs. at minimum cost for maintenance, take a tip from scores of power plants that report definitely improved lubrication with Gulf Parvis Oil.

Gulf Parvis Oil provides an extra margin of protection for hard-to-replace parts — helps prevent excessive wear that leads to shutdowns and below-par performance. Maintenance economies and greater operating efficiency are bound to accompany the proper application of a lubricant with the research background and proven service performance record of this quality Diesel lubricating oil.

If you are not one of the many enthusiastic users of Gulf Parvis Oil, it will pay you to investigate—call in a Gulf Lubrication Service Engineer today and ask him to recommend the proper type and grade to fit your particular requirements. Write or phone your nearest Gulf office.

GULF INDUSTRIAL LUBRICATION

GULF OIL CORPORATION
GULF REFINING COMPANY
GULF BUILDING, PITTSBURGH 30, PA.

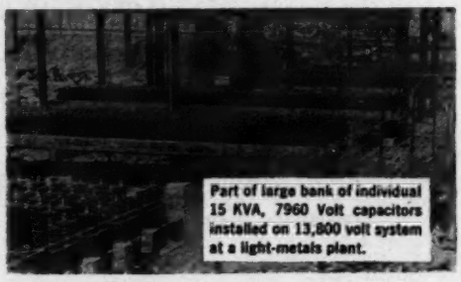
Back the Attack — Buy More War Bonds!

GET THE BEST FROM THE WORLD'S LARGEST

MORE VOLTAGE WHERE IT'S NEEDED QUICKLY

Large blocks of leading reactive current can be obtained quickly by using banks of C-D capacitors. Not only will they raise the voltage at critical load points, but they will also increase system capacity. C-D capacitor banks can be quickly reassembled to provide a variation in the corrective capacity, to conform to load requirements. This affords an electrical and physical flexibility not available in other types of corrective equipment.

Our field engineers will be glad to discuss with you the advantages of C-D capacitor banks. Write today to Cornell-Dubilier Electric Corp., So. Plainfield, New Jersey.



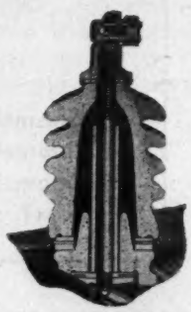
Part of large bank of individual 15 KVA, 7960 Volt capacitors installed on 13,800 volt system at a light-metals plant.

CORNELL-DUBILIER CAPACITORS

FOR POWER FACTOR IMPROVEMENT
CARRIER CURRENT COUPLING
SURGE PROTECTION

New C-D Petticoat Porcelain Bushing

C-D capacitors are supplied with double cone, wet-process, glazed porcelain bushings. Afford longer creepage path, less breakage hazard. Fitted with sturdy, solderless connector, in operation it has proved free from leakage.



About "tomorrow", we don't know much. We are not promising a new Chromel resistance wire that will last forever and a day, as a heating element. But we do assure you that Chromel will prove to be what it has always been—good, reliable resistance wire. Used as a cold or hot resistor it has all the properties desired. Further, these properties are good, consistently. This factor of consistency is vital, as a maintainer of good will, for all concerned.

Your judgment is sound when you specify or buy Chromel, for hot or cold resistors. Complete technical data is in Catalog-M, which we'll gladly send you.

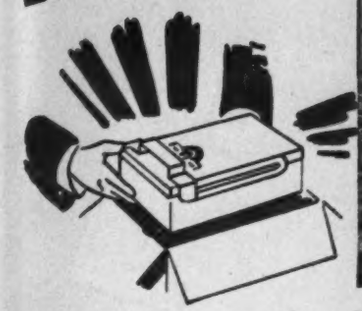
RESISTIVITY @ 68°F

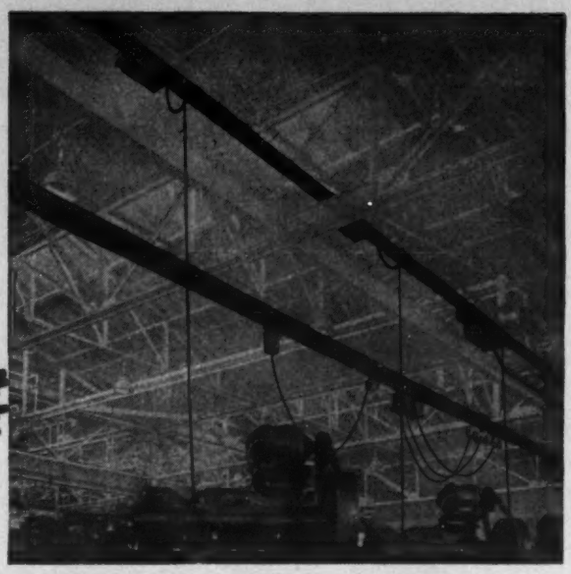
	WIRE (C.M. Ft.)	RIBBON (Sq. M. Ft.)
Chromel-A	650 Ohms	510 Ohms
Chromel-C	675 Ohms	530 Ohms
Chromel-D	600 Ohms	471 Ohms
Copel	294 Ohms	231 Ohms

Chromel
NICKEL CHROMIUM
HOSKINS CHROMEL
ELECTRICAL HEATING ELEMENT
WIRE

HOSKINS MANUFACTURING COMPANY, DETROIT 8, MICHIGAN

"wrap it up.."





"take it away"

Showing above, Flex-A-Power and Flex-A-Plugs to machines. Below, Trolley-Closur to portable tools.

FAMILIAR PHRASES THAT PICTURE

the SIMPLICITY... ECONOMY... SPEED...

of "PACKAGED" POWER DISTRIBUTION *by* TRUMBULL

FLEX-A-POWER

PLUG-IN SYSTEM

AERATED LVD

MAIN FEEDER SYSTEM

"PACKAGED" standardized stock 10′ sections and FLEX-A-PLUGS for distribution of power in secondary circuits and to "point of load" at machines or lighting connections. "A panelboard running the length of the plant". Interconnects with LVD Main Feeder Systems.

"INSTALL-AND-PLUG-IN" speed and convenience for all load connections through COMPLETE series of FLEX-A-PLUGS . . . self-contained protective switching or control units that may be plugged in anywhere along the run at 12″ intervals.

LOCALIZED POWER FACTOR correction at point of load provided through CAPACITOR FLEX-A-PLUGS. Also protection against phase failure through visual-indication GROUND DETECTOR FLEX-A-PLUGS.

COMPLETE, BALANCED power service installation with unlimited flexibility for future extension or relocation of machines with ALL needed accessories and time-tested Trumbull Engineering all the way.

"PACKAGED" standardized stock 10′ sections quickly connected and hung overhead, on pillars or against walls to provide in effect "a switchboard running the length of the plant". No time-consuming "special engineering" required.

AMPLE CAPACITY for *present or future* load is assured. Efficiency, safety and performance guaranteed by Trumbull pioneer engineering in this field.

"AERATED" LVD (low voltage drop) . . . full power delivery to point of load. High current-carrying capacity . . . ability to withstand high mechanical and electrical stresses with safety . . . minimum maintenance.

Write for Trumbullaid Bulletin No. 408, which also describes Trolley Closur for supplying power to portable tool.

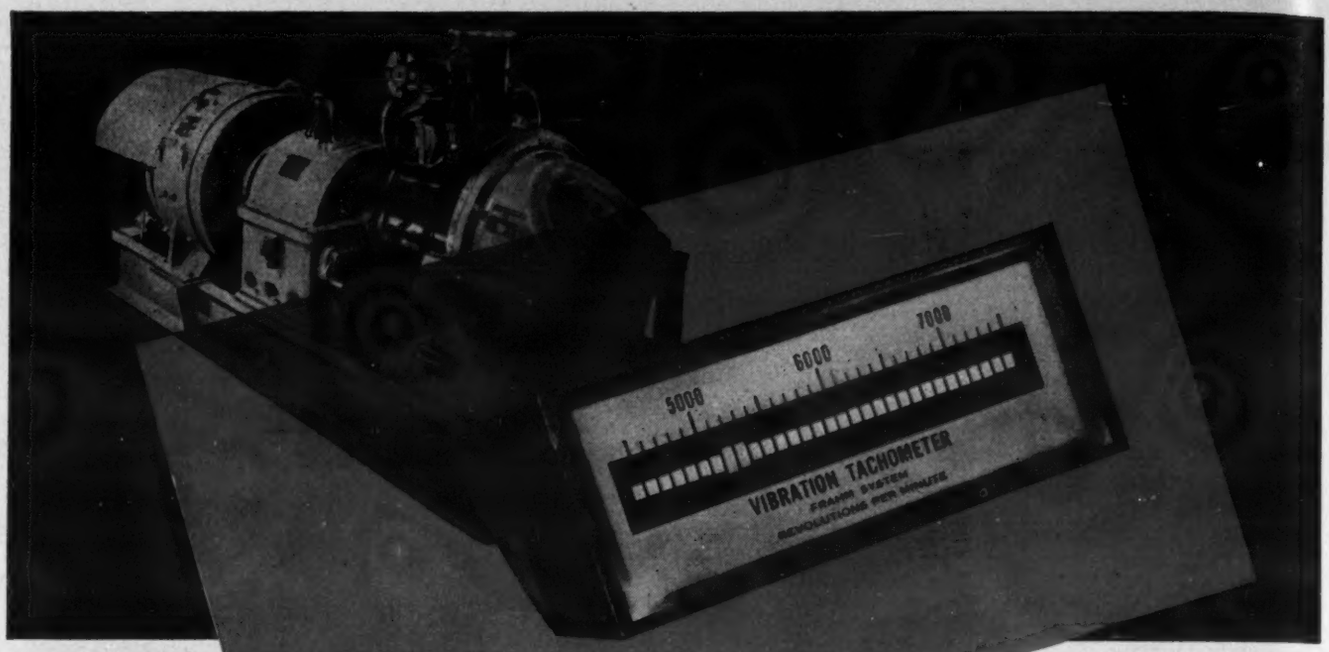
These systems because of their flexibility, prompt delivery and ease of installation, present great possibilities for use in reconversion of plant equipment.

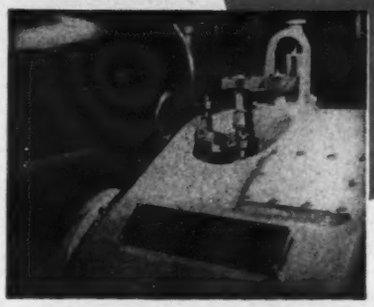
TRUMBULL

ENCLOSED BUS BAR DISTRIBUTION SYSTEMS

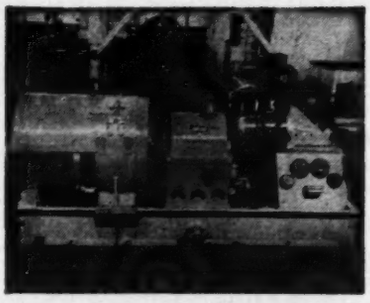
THE TRUMBULL ELECTRIC MANUFACTURING COMPANY • PLAINVILLE, CONN. • A GENERAL ELECTRIC ORGANIZATION

OTHER FACTORIES AT NORWOOD (CINN.) O. — SEATTLE — SAN FRANCISCO — LOS ANGELES





The simplicity of the Hendy governor is shown in this view. Power unit for the governor is an integral portion of the reduction gear assembly.



Over-all view of the 300 kw, 220/440-volt Hendy Turbo-generator, showing the sturdy welded steel bedplate and the compact arrangement of the complete set.

RIGHT ON THE NOSE

AT 5250 R.P.M.

Two important factors are brought out by that statement . . . first, Hendy Turbo-generator governors *hold* speed accurately regardless of load fluctuations; second, Hendy engineers, in their search for new and improved methods and materials, have made another valuable contribution to the operating efficiency of power-producing machinery.

The governor on Hendy turbines is greatly simplified over former types, requires no stuffing boxes or soft packing, utilizes anti-friction bearings in the linkages, and is enclosed within the gear-case. Individually, none of these new practices would materially affect closer speed regulation—but together, and combined with precise workmanship, they assure fine speed control over the entire range of no-load to overload conditions—resulting in uniform generator performance.

Hendy Turbo-generators are available for a-c or d-c output—from 250 to 750 kw capacity. Inquiries are invited on these standardized units—as well as on larger plants that will be available in the near future. Write for new booklet which gives more complete information.

JOSHUA HENDY Division

JOSHUA HENDY IRON WORKS

SUNNYVALE, CALIFORNIA

34-W

EST. 1854

Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • ST. LOUIS • WASHINGTON • LOS ANGELES

IT CAN'T HAPPEN HERE WHEN IT'S TREATED WITH OSMOPLASTIC

● The situation illustrated above has been repeated more than a million and a half times. How much in dollars Osmoplastic has saved electrical utilities, we wouldn't even hazard a guess. We know, however, that were it not for Osmoplastic ground line treatment, many companies would be hard put now in these days of critical pole and labor shortages . . . a condition which is just as serious in the woods as it is in Utility stockpiles.

There is no special "season" for Osmoplastic treatment. Whenever you inspect your poles, protect them with Osmoplastic. Simplified record systems are available to expedite and control the work. We would like to give you the full story at your convenience.

A few of more than a hundred leading utilities that have conserved poles by treating more than a million and a half of them with Osmoplastic.

INTERSTATE POWER COMPANY
NEW JERSEY BELL TELEPHONE COMPANY
Otter Tail Power Company
VIRGINIA ELECTRIC AND POWER COMPANY
NEW YORK TELEPHONE COMPANY
WESTCHESTER LIGHTING COMPANY
POTOMAC EDISON COMPANY
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The Edison Electric Illuminating Company of Boston
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CONSUMERS POWER CO.
JERSEY CENTRAL POWER & LIGHT CO.
Wisconsin Public Service Corporation
WEST PENN POWER COMPANY
New York State Electric & Gas Corporation
Northern Pennsylvania Power Company
PUBLIC SERVICE COMPANY OF COLORADO
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MAKE INSPECTION TIME, PROTECTION TIME WITH
OSMOPLASTIC
MANUFACTURED BY
OSMOSE WOOD PRESERVING COMPANY OF AMERICA, INC.
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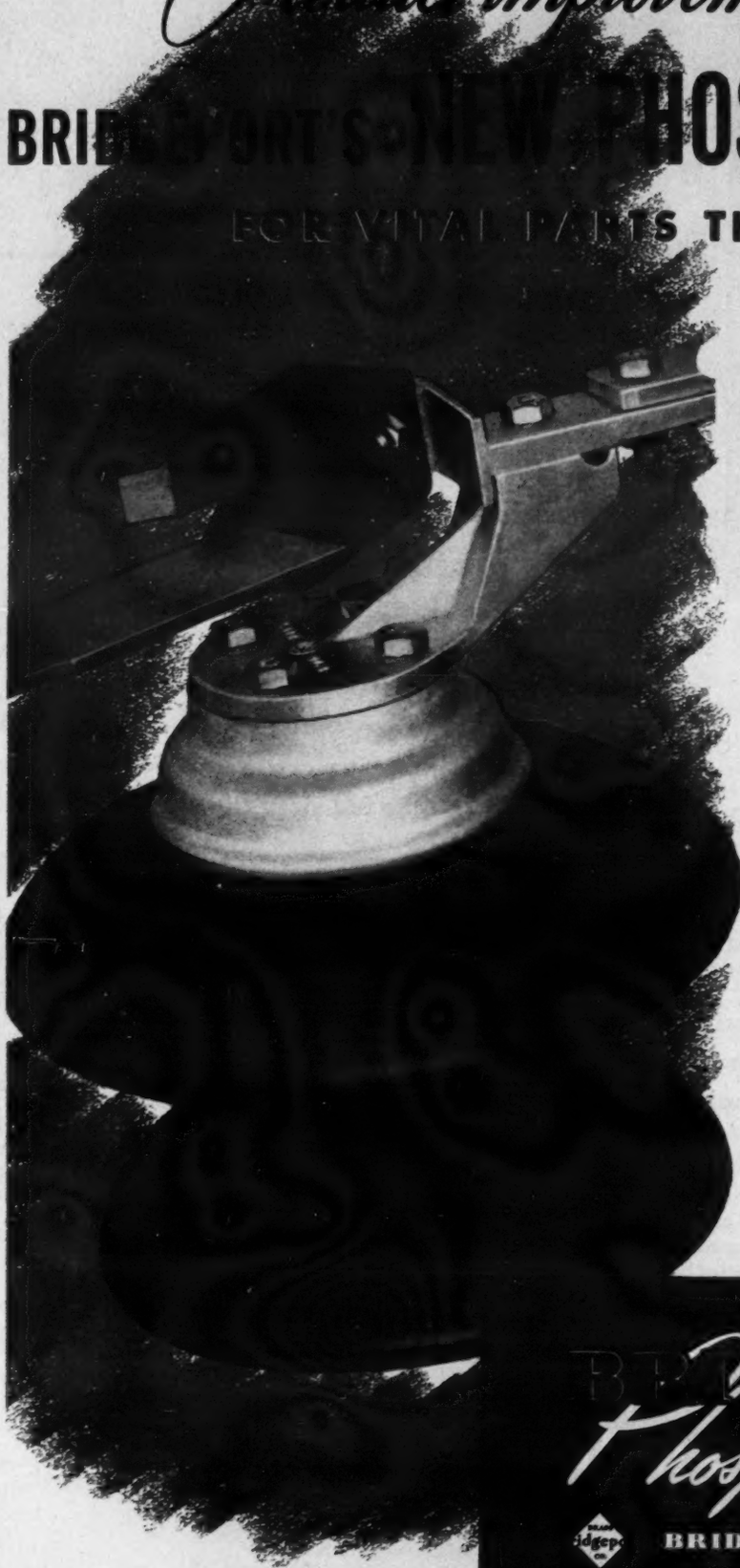
Product improvement through

BRIDGEPORT'S NEW IMPROVED PHOSPHOR BRONZE

FOR VITAL PARTS THAT MUST NOT FAIL



When thousands of lives and the power for vitally needed war production depend upon a little piece of metal—that metal must be *good.* That is why Bridgeport's IMPROVED Phosphor Bronze was selected by Delta-Star for the vital spring contact of this high tension switch. This part must maintain a definite pressure in order to assure unfailing electrical contact despite outdoor temperature extremes, weathering, smoke, dust, and dirt. Moreover, because installations usually are not readily accessible, such equipment must be absolutely dependable.

Bridgeport's IMPROVED Phosphor Bronze has exceptional resilience and fatigue resistance. It combines high strength with resistance to severe corrosion, and freedom from season cracking. This alloy is used in radar and radio equipment, electrical switches, and in many other electrical applications. The tendency today is to improve products—make them more lasting—by using better materials. Examine your product critically with an eye to making it better through the lasting spring qualities, high strength, easy workability, and other fine properties of Bridgeport's IMPROVED Phosphor Bronze.

Get in touch with our nearest branch office for suggestions on the improvement of your product through Bridgeport's modern engineering alloys.

Mill orders will be accepted in accordance with existing priority regulations.

BRIDGEPORT

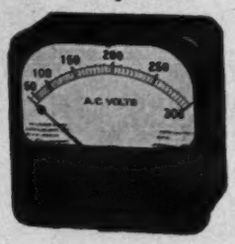
Phosphor Bronze

BRIDGEPORT BRASS COMPANY

"STEEL-SIX" Portable TESTING INSTRUMENTS

PANEL INSTRUMENTS

Included in the broad range of electrical instruments that bear the R-S mark are the 3.5" miniature panel instruments shown below. These are built in commercial types and to A.S.A. War Standard C 39.2-1944. Other R-S instruments include switchboard and portable types to meet practically every industrial, power and laboratory need. Let us quote prices and deliveries on your instrument requirements.



Roller-Smith "Steel-Six" portable testing instruments were designed primarily for general testing where a highly accurate, and moderately priced instrument is required. The rugged all-metal case is both dust- and moisture-proof and also furnishes full magnetic shielding of the movement. Large window openings combined with well-designed dials set exceptionally close to the front of the case afford unusual readability. Instruments are approximately 6" square by 4" in depth. Ratings cover a broad range of testing requirements.

"Steel-Six" testing instruments are supplied with single or multiranges for the measurement of direct current in amperes, milliamperes, volts and millivolts; for alternating current measurements of amperes, milliamperes, volts, watts, power factor and frequency. Catalog 4340 contains complete information. Send for a copy today.

ROLLER SMITH

Sales Representatives in all Principal Cities

ROLLER-SMITH BETHLEHEM, PENNA.

Canadian Plant: ROLLER-SMITH MARSLAND LTD., Kitchener, Ontario

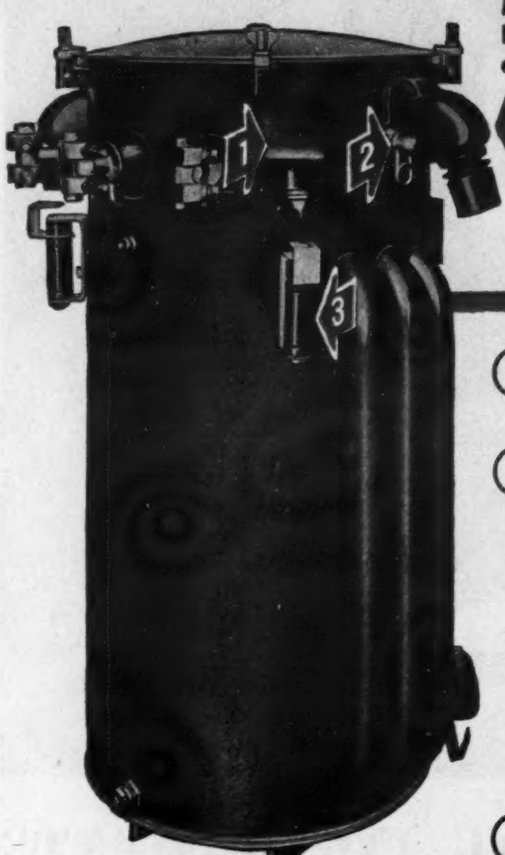
STANDARD AND PRECISION ELECTRICAL INSTRUMENTS OF EVERY TYPE

Wagner

SELF-PROTECTED
DISTRIBUTION TRANSFORMERS

Maximum savings are realized through the use of Wagner Self-Protected Distribution Transformers because of their improved design, high-quality construction, ease of installation, and high efficiency – a combination of superior characteristics which assures users of low operating and maintenance costs.

Two of the outstanding Wagner Distribution Transformers are the types HEX-P and HEBF-P illustrated. These transformers embody the following features to meet the requirements for surge and overload protection.



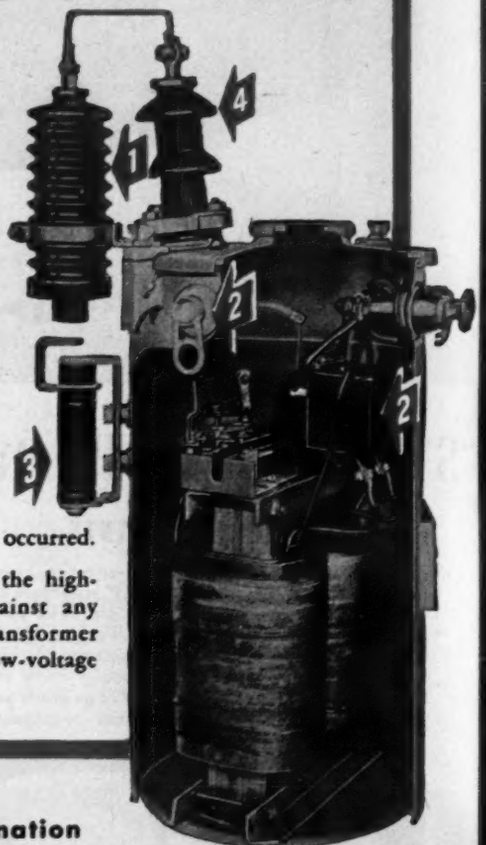
Type HEX-P, 50-kva Distribution Transformer

(1) De-Ion Gap protects transformer against surges. The ability to discharge extremely high surge currents is its outstanding characteristic.

(2) Secondary circuit-breaker protects transformer from secondary short-circuits and overloads. Circuit breakers with overload warning signal-light are furnished on 5-kva sizes and above. 1½ to 3-kva sizes are equipped with breaker only. Breaker reset handle is easily accessible. When furnished, warning signal-light is built into the reset handle.

(3) The De-Ion Gap is isolated from the ground series-resistor by a gap. The external series-resistor is furnished in order to limit the power-current which may flow after a surge has occurred.

(4) Protective links are placed in series on the high-voltage side to protect the feeder against any short circuit that might occur in the transformer windings. The fuse is coordinated with the low-voltage circuit-breaker.



Type HEBF-P, 3-kva Distribution Transformer

WAGNER
Products for Industry include:
MOTORS
•
TRANSFORMERS
•
INDUSTRIAL BRAKES
•
INDUSTRIAL BRAKE LINING

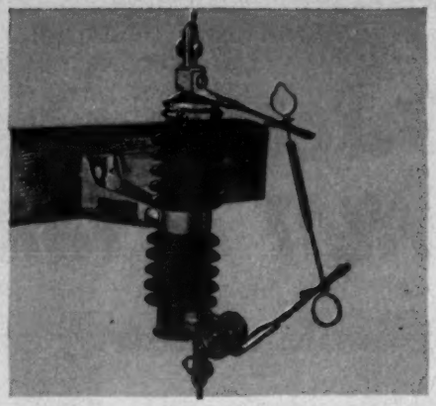
Write **For Full Information** on the Complete Line of Wagner Transformers.

FOR VICTORY—BUY U. S. WAR BONDS AND STAMPS...

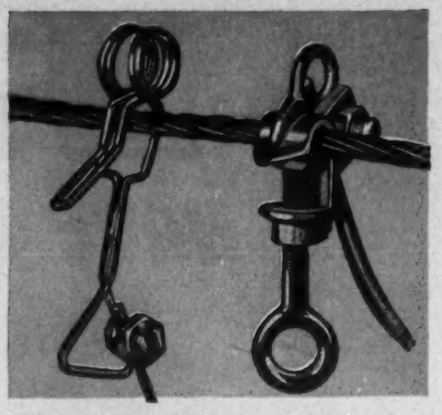
Wagner Electric Corporation
ESTABLISHED 1891
6456 Plymouth Avenue, St. Louis 14, Mo., U. S. A.
ELECTRICAL AND AUTOMOTIVE PRODUCTS

T44-12

FUSE LINKS—individually wrapped, then packaged again in packets of five, arrive at the pole just the way they leave the Kearney factory.



LOW MASS, extra-flexible switch parts mean high resistance to mechanical shock and heavy short-circuit rupturing capacity.



CLAMPS. There is a Kearney Con-nec-tap clamp for the most unusual load or construction problem. Made in many types for all wire sizes.

COMBAT LIGHTNING THE EASY WAY

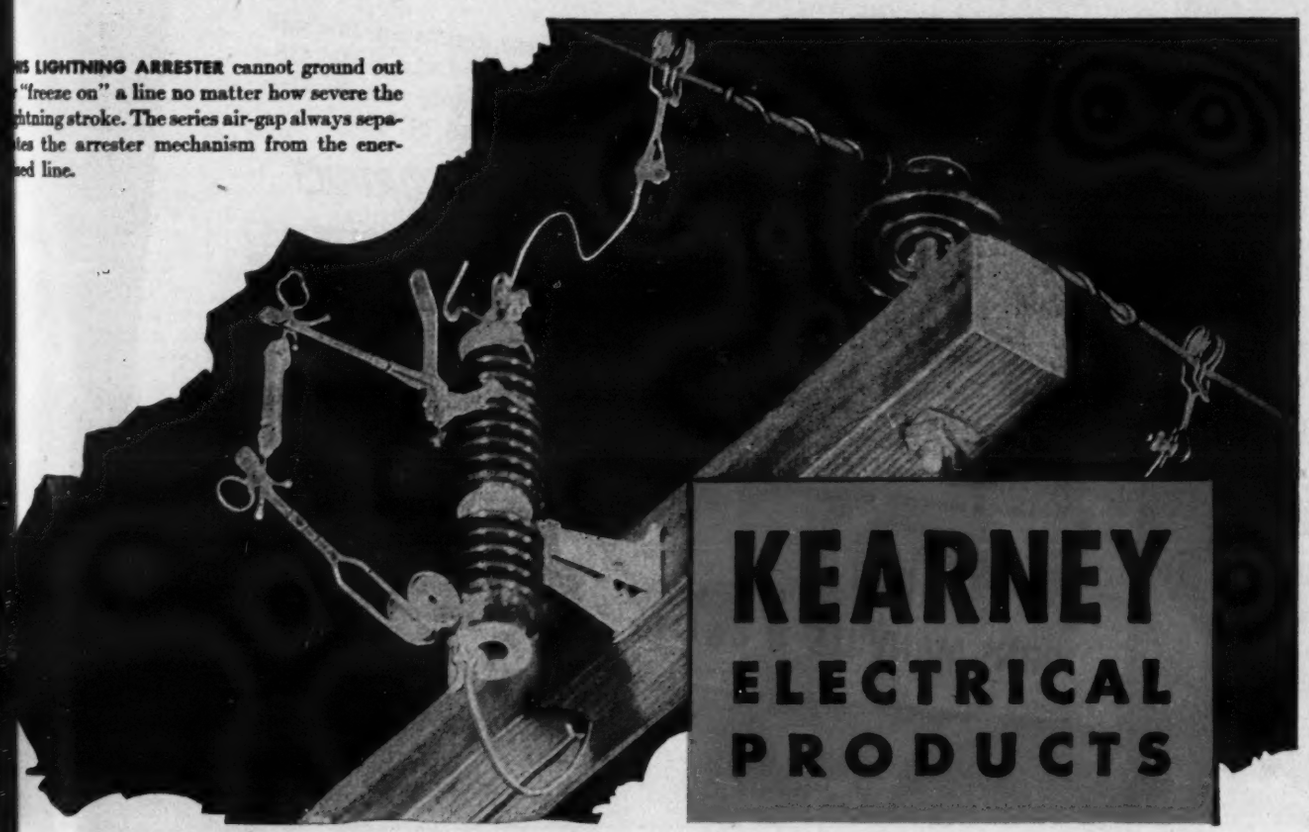
Are you trying to combat lightning discharges the hard way? You are if you're using devices that attempt to choke surges by interposing a high resistance in the path to ground. This method has the effect of keeping a high percentage of the surge on your lines where it may spill over bushings, line insulators or break through transformer windings. In consequence these choked and reflected surges are the direct cause of the many outages from fuse link blowings if not more serious damage, after lightning storms.

The easy way is to direct lightning surges to ground through a low resistance path so that all of the surge, electrical stress and reflected voltage is drained to ground within a fraction of a microsecond. Power follow-ups are snuffed out usually within the first current zero and your lines will operate through many lightning storms without even blowing a fuse link. This is what you may confidently expect when you change to Kearney Lightning Arresters. What's more you start off with the initial advantage of paying much less for the Kearney Arresters—and they will continue to pay dividends by reducing fuse-blowings, trouble-trips and lightning outages to a new low.

Please address your letter to Department "H",

JAMES R. KEARNEY CORPORATION
4236 Clayton Avenue, St. Louis 10, Missouri

PRACTICAL—SERVICEABLE—DEPENDABLE



THE LIGHTNING ARRESTER cannot ground out or "freeze on" a line no matter how severe the lightning stroke. The series air-gap always separates the arrester mechanism from the energized line.

KEARNEY
ELECTRICAL
PRODUCTS

These Ducts HAVE WHAT IT TAKES

—for reliable cableway service

Here are some outstanding reasons why J-M Transite Conduit and Korduct serve so well under the most severe conditions—

Inorganic . . . made of an asbestos and cement composition which provides permanence and strength, makes the ducts immune to rust or rot.

Permanently smooth bore . . . long cable pulls and replacements are made easier. Danger of damage to cables is minimized.

Easily and quickly installed . . . long, light-weight lengths and simple assembly method assure rapid, economical installation.

Immune to electrolysis . . . being entirely inorganic and non-metallic, these ducts are not affected by electrolytic or galvanic action.

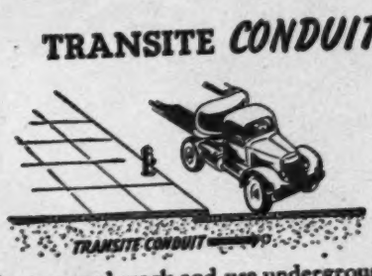
Lower cable temperatures . . . an advantage resulting from a relatively high rate of heat dissipation.

Incombustible . . . won't contribute to the formation of dangerous smoke, gases, or fumes. If burnouts do occur these inorganic ducts provide maximum protection to adjacent cables and permit easy removal of damaged conductor.

* * *

For complete details on Transite Ducts, write for Data Book, DS-410, Johns-Manville, 22 E. 40th St., New York 16, N. Y.

TRANSITE *CONDUIT*



For exposed work and use underground without a concrete encasement.

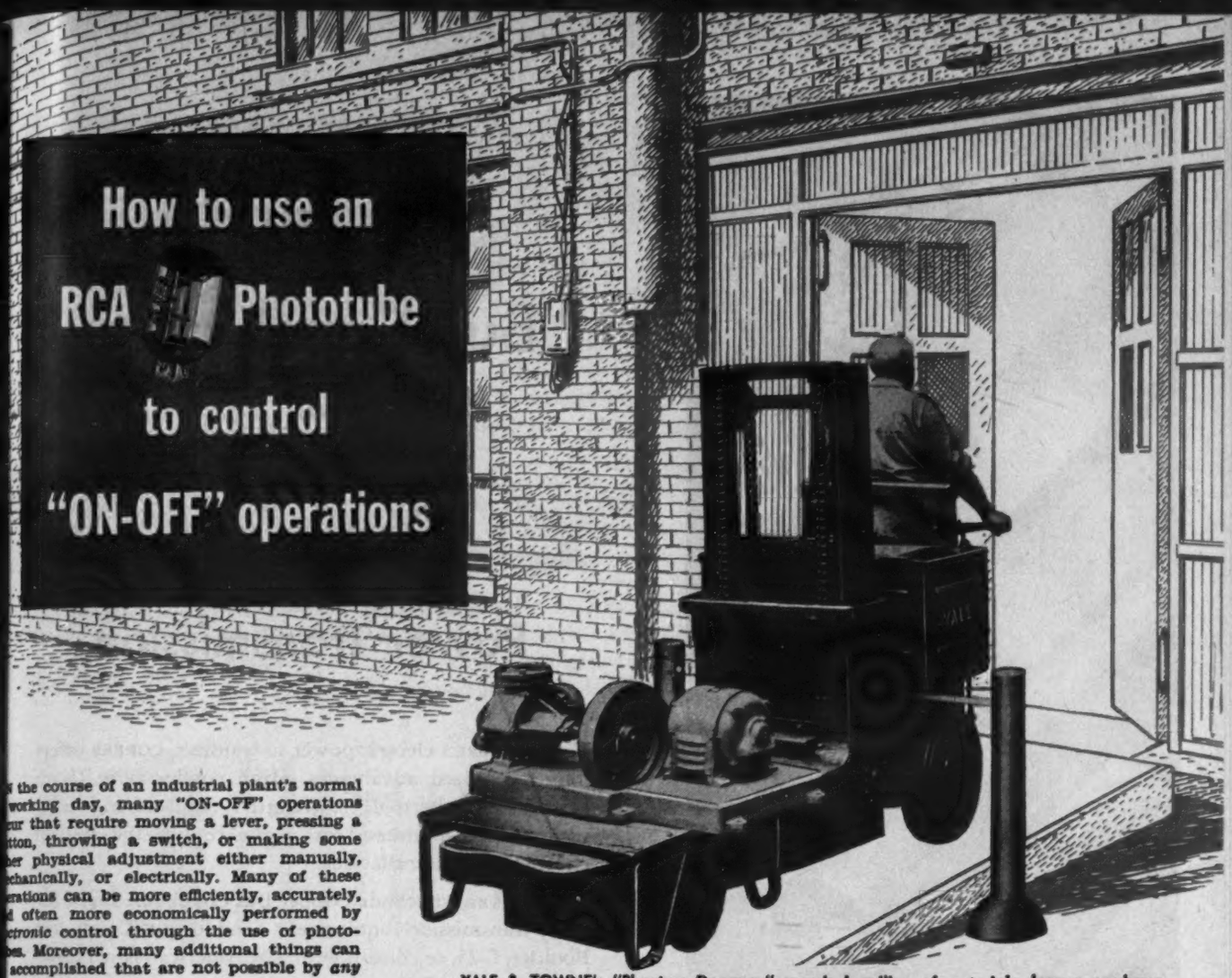
TRANSITE *KORDUCT*

For installation in concrete. Thinner walled but otherwise identical with Transite Conduit.

JM PRODUCTS

JOHNS-MANVILLE ***TRANSITE DUCTS***

How to use an RCA Phototube to control "ON-OFF" operations



YALE & TOWNE's "Phantom Doorman" speeds handling of materials, lessens employee fatigue, reduces door maintenance, saves heat loss, reduces noise and drafts, and prevents damage to goods in transit. Time-delay holds door open until truck has passed through.

In the course of an industrial plant's normal working day, many "ON-OFF" operations occur that require moving a lever, pressing a button, throwing a switch, or making some other physical adjustment either manually, mechanically, or electrically. Many of these operations can be more efficiently, accurately, and often more economically performed by electronic control through the use of phototubes. Moreover, many additional things can be accomplished that are not possible by *any* other existing method.

Electronic Door-Openers. An electronic "ON-OFF" control device familiar to many is the automatic door-opener, such as *"The Phantom Doorman"* manufactured by YALE & TOWNE of Stamford, Conn. The magic brain that controls it is the trio of RCA Electron Tubes—a phototube and 2 metal amplifier tubes—illustrated in the diagram below.

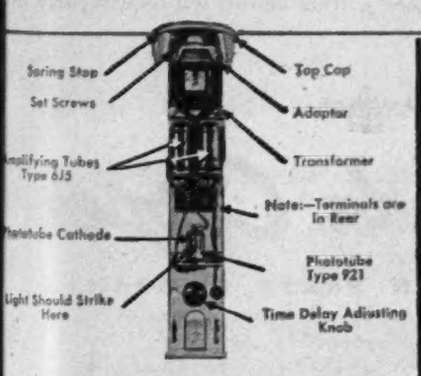
Other Applications. This same principle, of automatically "throwing a switch" by means of a device actuated by the interruption of a beam of light, has almost limitless industrial applications. Sorting or grading objects according to their height or width, for example. Or counting up to as many as 1000 units per minute, and much higher if electronic counting circuits are utilized. Or for totalizing where, for instance, it's important to know exactly how many items on a production or assembly line were started, completed, and are still in process. Separating objects by color, and counting the number of each. Starting and stopping paint sprayers so paint isn't wasted. Level controlling for bottling or pumping operations. Detecting breaks in continuous paper- or textile-runs and automatically stopping the press or loom when the break occurs. Observing traffic statistics, switching traffic lights, or giving warning by light or bell when a vehicle approaches a hidden corner. And so on *ad infinitum!*

Have You a Problem? Whether your particular interest lies in increasing efficiencies or reducing hazards through the use of electronic door-openers or any other electronic control device, RCA may be able to help you. Why not write to us, stating your problem, so we can refer you to the equipment manufacturer best fitted to serve you? And if you would like our 32-page, illustrated booklet *"Electrons in Action at RCA,"* we will gladly mail you one. Simply write to RCA, Commercial Engineering Section, 640 South 5th St., Harrison, N. J.

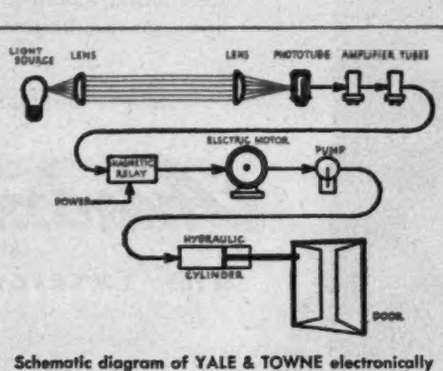
The Magic Brain of all electronic equipment is a Tube, and the fountain-head of modern Tube development is RCA.

Listen to "THE MUSIC AMERICA LOVES BEST" on the RCA program every Saturday, 7:30 p.m., E.W.T., Blue Network.

BUY MORE WAR BONDS



YALE & TOWNE's Photo Relay, showing interior construction and positioning of 3 RCA Electron Tubes.



Schematic diagram of YALE & TOWNE electronically controlled device for automatically opening a door when an approaching person or vehicle interrupts a beam of light.

RCA

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION · CAMDEN, N. J.

LEADS THE WAY . . . In Radio . . . Television . . . Tubes . . . Phonographs . . . Records . . . Electronics

Anaconda Bus Conductors for LOW-LOSS Power Transmission

WHEN THERE'S electric power to transmit, COPPER offers long-recognized advantages. High conductivity (both electrical and thermal) . . . strength . . . high corrosion resistance and moderate cost make copper the logical choice for bus installations.

There's an Anaconda Copper Bus Conductor shape for every transmission requirement. Send for Bus Conductor Booklet, C-25, or consult with The American Brass Company Technical Department.

CABLES solve many problems in conducting extremely heavy currents in confined space or in connecting moving apparatus such as arc or resistance furnaces.

BARS requiring minimum space may be bent or twisted, connected to apparatus without special joint preparation, and in laminated construction have unlimited d.c. capacity.

TUBES provide the highest bus conductor efficiency at a.c. frequencies, have greater rigidity, and may be oil or water cooled.

CHANNELS with large surface area and ventilation feature, reduce temperature rise, have greater rigidity for long runs than tubes, flat surfaces for tap-off.

ANGLES ventilated hollow busses with highest rate of heat dissipation, handle greater current density but require more space for installation. 44111

ANACONDA

Anaconda Copper

THE AMERICAN BRASS COMPANY

Subsidiary of Anaconda Copper Mining Company

General Offices: Waterbury 88, Connecticut

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

Hole ASSISTANTS

★ In performing installation and general service duties, users of HIGHWAY General Utility Bodies have the kind of assistance that counts in terms of efficiency.

These bodies available, in three types, are compact yet roomy, fully enclosed and all metal construction. Provided with well arranged compartments, tools and materials are kept orderly at all times.

They are a logical choice for utilities planning ahead for the very best in installation and general service facilities. Like all HIGHWAY equipment, these bodies were designed as a result of years of contact with the field so as to most fully meet all requirements.

HIGHWAY GENERAL UTILITY BODIES

HIGHWAY TRAILER COMPANY

MANUFACTURERS OF

TRUCK TRAILERS AND BODIES • EARTH BORING MACHINES • WINCHES • OTHER PUBLIC UTILITY EQUIPMENT

General Offices

EDGERTON, WIS., U. S. A.

HOW STEEL ~~STRETCHES~~ THE SYLVANIA LINE OF "COMPLETE PACKAGES OF LIGHT"

Government release of steel for fluorescent fixture fabrication enables Sylvania to round out its line of "complete packages of light" to fit all industrial and commercial general lighting requirements.

Now there are SEVEN INDUSTRIAL UNITS

Continuous-Row Type

Back into the line come these outstanding Sylvania Fixtures with steel reflectors, designed primarily for continuous-row or end-to-end installations. They are made with the same high quality materials available in 1942.

Single (4-foot) channel top-housing

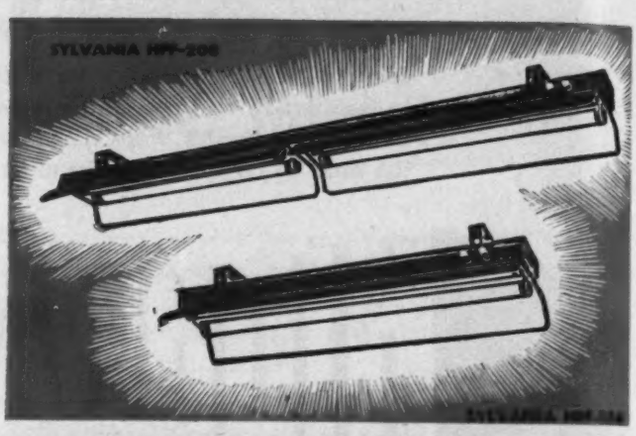
HFF-104—two 40-watt lamps, for continuous-row mounting
HFF-154—three 40-watt lamps, for continuous-row mounting

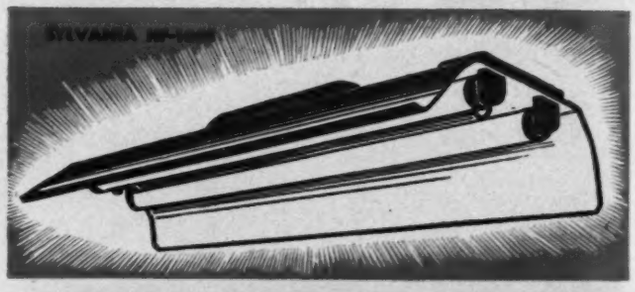
Double (8-foot) channel top-housing

(Continuous wire-way enclosure reduces cost of continuous-row installations)

HFF-208—four 40-watt lamps, for continuous-row mounting
HFF-308—six 40-watt lamps, for continuous-row mounting

All models come completely equipped with lamps, ballasts, and starters — pretested and ready for immediate installation.





All-Purpose Type

The famous Sylvania "Fixture of the Future," which has proven so popular in war industry, is now available with a reflector drawn from 20-gauge steel, with a reinforcing lip. Finished with durable synthetic enamel. For either continuous-row or individual mounting.

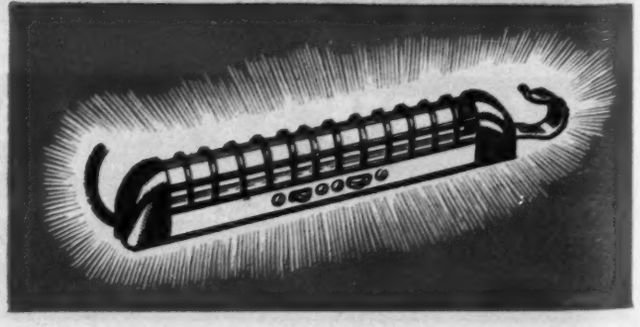
HF-100S steel reflector has knockouts that provide for easy conversion from two to three lamps. The streamlined top-housing in all models has knockouts that make almost any type of mounting possible. Supplied in "complete packages of light" with lamps, starters, and ballasts, pretested, wired, and ready for immediate installation.

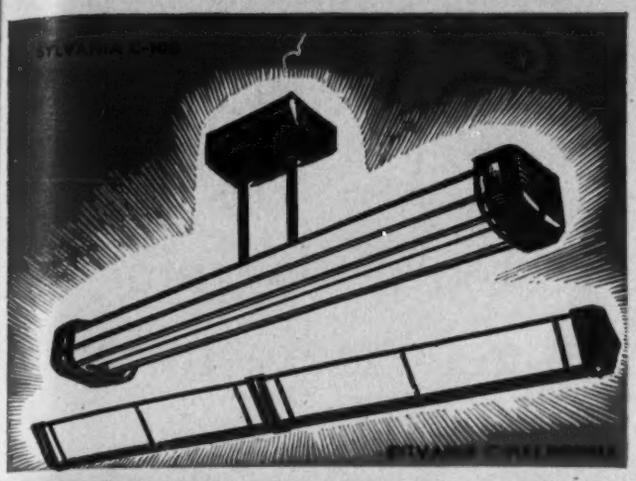
HF-100S—two 40-watt lamps
HF-150S—three 40-watt lamps
HF-235S—two 100-watt lamps

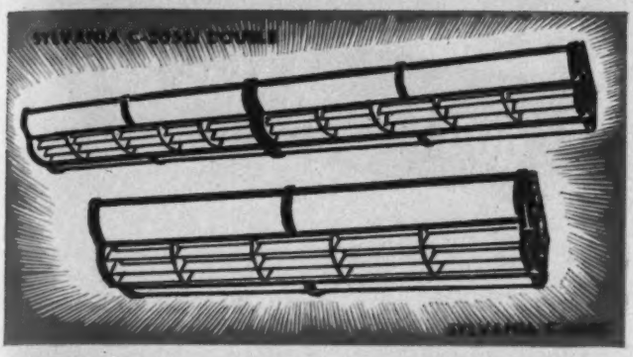
SYLVANIA
ELECTRIC PRODUCTS INC.
Salem, Massachusetts
Fluorescent Lamps, Fixtures and Accessories, Incandescent Lamps
Radio Tubes, Cathode Ray Tubes, Electronic Devices

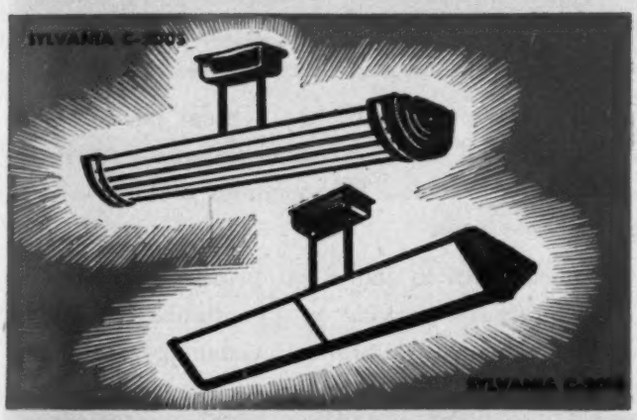
Portable FLUORESCENT WORK LIGHT FOR INDUSTRY

P-7 Sylvania Extension Cord Lamp makes fluorescent light portable for the first time. Compact dimensions — 10¼" x 1 3/16" x 1⅞". Goes anywhere the hand can reach in close-quarter work. Cool and adequate light from a 6-watt Sylvania Fluorescent Lamp is safe and efficient. Steel guard prevents lamp breakage. Handy hook leaves both hands free to work. Operates on 110-125 volts, 60-cycle, AC only.









Now there are SEVEN COMMERCIAL UNITS

Two-Lamp Shielded and Unshielded

It is now possible to resume the manufacture of this handsome and adaptable series. All models have steel reflectors and employ 40-watt lamps. This variety of models will make for wider fluorescent application to the commercial and institutional field.

Two 40-watt Lamps

C-100 unshielded with pendant
C-101 shielded with pendant
C-113 unshielded surface-mounted
C-115 shielded surface-mounted

All models are supplied with Sylvania Lamps as "complete packages of light."

•

Louver Type

These highly efficient fixtures are decorative in appearance but functional in design, with diffusing panels on each side of the lamps and louvers directly beneath. Equipped with four 40-watt lamps. Steel reflectors.

Four 40-watt Lamps

C-205S individual surface-mounted

•

Four-Lamp Shielded and Unshielded

These Sylvania Fixtures, which are ideal for stores, offices, laboratories and hospitals, now are equipped with 20-gauge steel reflectors finished with synthetic enamel. New design hinged end-caps and hinged diffusing panels make for easier and speedier maintenance. Supplied complete with four 40-watt Sylvania Fluorescent Lamps, Dua-Lamp Auxiliaries, and Starters — pretested and ready for immediate installation. Available with or without pendant.

Four 40-watt Lamps

C-200S unshielded, surface-mounted, individual
C-201S shielded, surface-mounted, individual

Leading Manufacturer of Fixtures in the Fluorescent Field

IF YOU HAVE A PROBLEM TO WHICH FLUORESCENT LIGHT MAY BE APPLIED, WHY NOT CONSULT SYLVANIA ENGINEERS?

SYLVANIA "COMPLETE PACKAGES OF LIGHT"

Industrial Fixtures		*Commercial Fixtures*	
HFF-104	( )	C-100	( )
HFF-154	( )	C-101	( )
HFF-208	( )	C-113	( )
HFF-308	( )	C-115	( )
HF-100S	( )	C-205S	( )
HF-150S	( )	C-200S	( )
HF-235S	( )	C-201S	( )
P-7	( )		

SYLVANIA ELECTRIC PRODUCTS INC., Boston Street, Salem, Mass.
Dept. EW-744

Please send me information on the fixtures I have checked.

Name_____

Title_____

Firm_____

Address_____

City_____ State_____

IF you're not interested in bargains . . . or don't care to get "more for less"

don't read this ad

This ad—second in a series on "De-ion" (fuseless) Circuit Breakers for 1944—is addressed to those men in American industry who are genuinely interested in bargains . . . who insist on the best . . . who demand more for less.

Every industry, large or small, has a great portion of its working capital invested in electrical equipment served by 220, 440, or 550-volt circuits. This includes motors, welders, compressors, machine tools.

One of the main keys to industrial profit, therefore, lies in keeping this equipment working on a continuous production basis, minimizing extended shutdowns or damage from overloads or short circuits.

This overload and short circuit protection can be secured through the use of a wide variety of devices. And—that's where the "bargain"—or how to get "more for less" comes in. For, most of these devices—while affording adequate protection—certainly aren't designed for the man who wants the best. Nor are they bargains.

They do the job—there's no doubt about that. But how do they do it? Are they efficient? How much do they cost? Are they real bargains? Do they give you "more for less"?

These are questions to which every seeker of real value should demand definite answers. J-60558

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

there's only one modern method of PROTECTING ELECTRICAL EQUIPMENT . . .

THE "DE-ION" *(fuseless)* CIRCUIT BREAKER FOR 1944!

THIS BREAKER IS THE REAL BARGAIN AMONG PROTECTIVE DEVICES, IN THAT IT GIVES YOU "MORE FOR LESS".

here's how...

1. More positive "plus" protection . . . the same protection that safeguards vital equipment on our modern battleships when failure may mean defeat.

2. More output per machine . . . does not interrupt production on harmless momentary overloads; thus preventing many work stoppages or delays.

3. More safety... working parts are completely enclosed and sealed. These breakers are the safest protective devices ever built. They are absolutely tamperproof (cannot be bridged or blocked by pennies, nails or other foreign articles).

4. More productive machine-hours... assures faster resumption of interrupted service after causes of overloads or short circuits are removed. There is nothing to replace or repair—to restore service, simply throw the handle. This feature alone saves American industry more than one million man-hours yearly.

5. Less cost... the lifetime cost of the "De-ion" (fuseless) Circuit Breaker of 1944 is less than that of any other protective device. Ask your Westinghouse representative for facts and figures. Westinghouse Electric & Manufacturing Co., Dept. 7-N, East Pittsburgh, Pa.

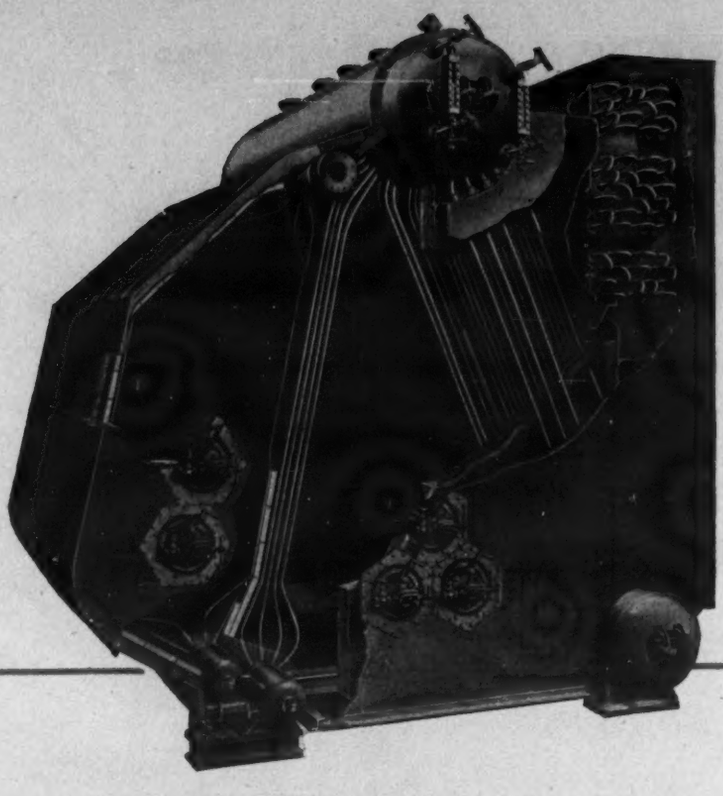
"DE-ION" *(fuseless)* CIRCUIT BREAKERS

Highest Army and Navy

For the fifth time Foster Wheeler's Carteret Works has been awarded the Army-Navy "E" for excellence in production. Working to the exacting standards of Navy inspection, the shops are turning out unprecedented quantities of equipment.

- ★ Steam Generators, Condensers and Distillers for the Navy, Maritime Commission and our Allies.
- ★ Power Plant Equipment for War Plants here and abroad.
- ★ Petroleum, Petro-Chemical and Chemical Plants for the U. S. and our Allies.
- ★ Chemical Processing Equipment for Ordnance Plants.

FW FOSTER



Award to Foster Wheeler

The marine separately-fired superheater type steam generator, engineered and developed by Foster Wheeler, is standard equipment on naval combat ships. This design proved an influential factor in the development of stationary boilers incorporating the separately-fired superheater furnace principle and culminating in the Twin Furnace Steam Generator.

FOSTER WHEELER CORPORATION
165 BROADWAY • NEW YORK 6, N. Y.

WHEELER FW

The Shortest Distance . . .

or the longest, flat terrain or mountainous [illegible], regardless of the job, Hoosier engineers can efficiently and economically supplement your own organization in the erection and maintenance of transmission lines. Our engineers, trained men and special equipment are strategically located throughout the United States and Canada ready to serve you in helping keep America's power-lanes open.

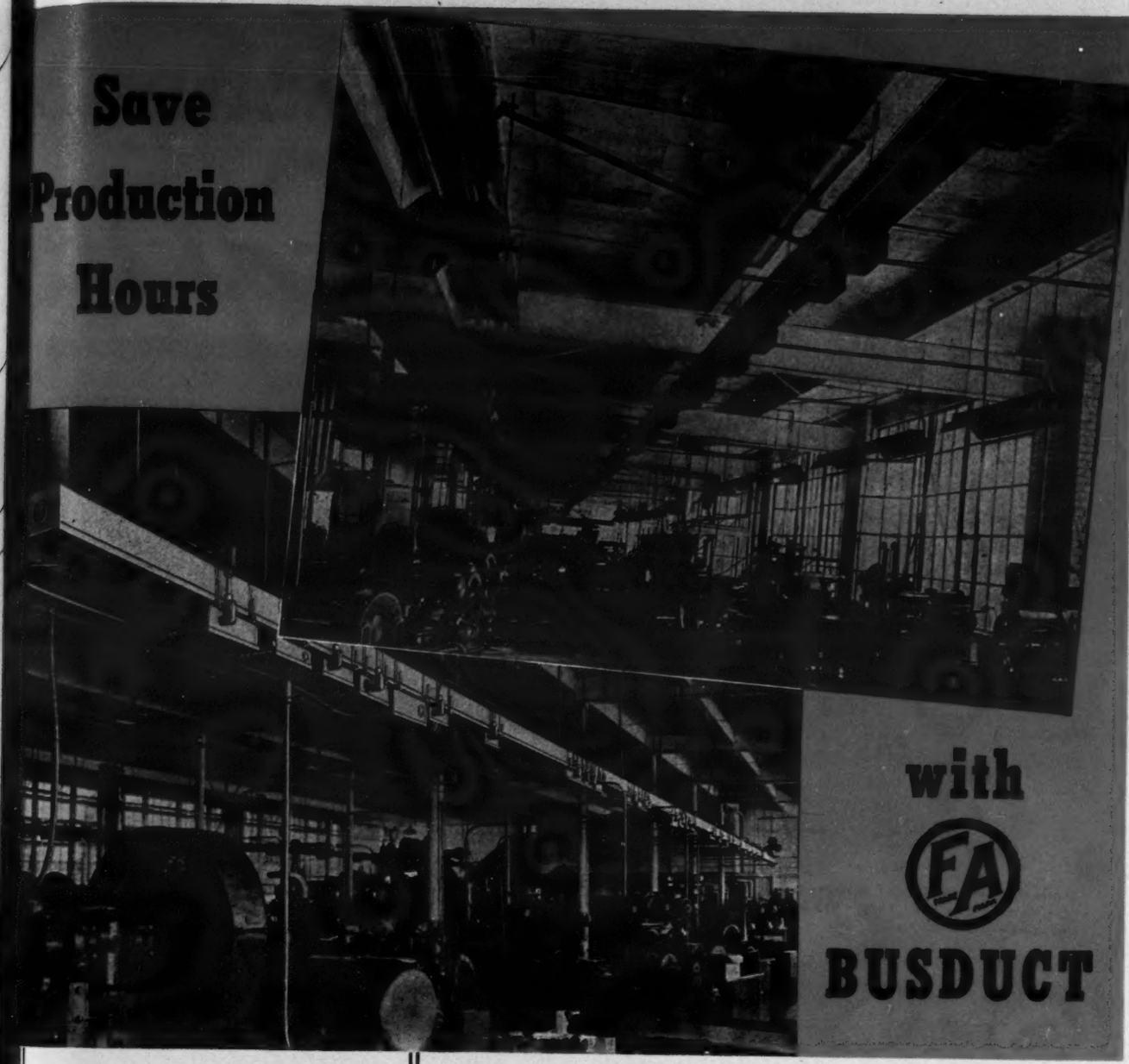
HOOSIER ENGINEERING CO.

46 S. FIFTH ST. COLUMBUS, OHIO

NEW YORK • CHICAGO

ERECTION AND MAINTENANCE OF TRANSMISSION LINES

Save Production Hours



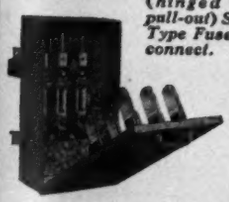
with FA BUSDUCT

FA PLUGIN DEVICES

The FA Plugin Devices can be arranged to go on either or both sides of the Plugin FA Busduct, and each Plugin device is supported by independent fastenings. All FA Plugin Devices are equipped with proper capacity of rugged compression type bus bar connectors. They are made in three types. See illustrations below:

At left: FA Circuit Breaker Type.

Below: FA Klampswitchfus (hinged type pull-out) Safety Type Fuse Disconnect.



Above: FA Shutlbrak (operating Switch) with Kamklamp Fuse Holders.

This is the *modern* method of light and power distribution . . . Relocation of machines is readily accomplished, with minimum interruption of operating time. Just "move the machine—plug in—go"! . . . If desired, FA Busduct may be taken down and moved to new location—quickly, and without appreciable loss of material . . . Economical for small plants as well as large, this convenient and flexible system (designed for 2, 3 and 4 wire systems, 575 volts AC, maximum) is installed at surprisingly low cost.

The FA Sales-Engineer can help you in planning an efficient and convenient FA Busduct Distribution System. No obligation, of course. Write for name of the one nearest you—and for Bulletin 65 (and supplement) . . . Frank Adam Electric Co., Box 357, St. Louis, Mo.

FA Busducts are now made under W.P.B. Limitation Order L-273. They have the same basic features of construction as the standard model.

Frank Adam
ELECTRIC COMPANY
ST. LOUIS

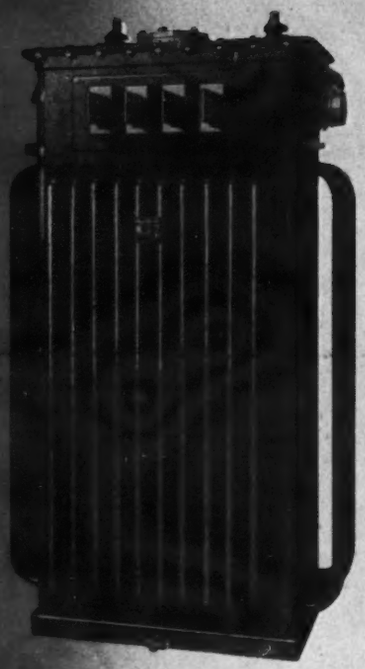
THE ANSWER TO MANY O

Standard

TRADE MARK

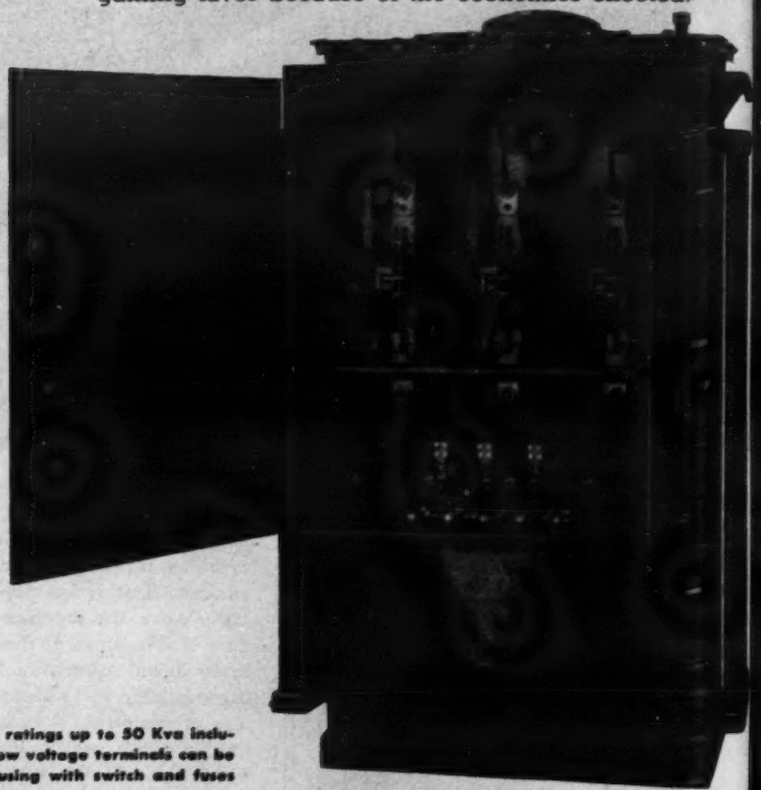
You can save vital time, floor space and installation co by specifying Standard ASKAREL-COOLED Transformer Built to AIEE and NEMA specifications, these Standar units are entirely safe and approved for use up to rate capacities indoors or outdoors without separate housing or vaults.

Some of the more popular designs are illustrated here Capacities up to 10,000 Kva are available. Built-i switchgear and overload protection is a feature rapidly gaining favor because of the economies effected.



Standard Askarel-Cooled distribution transformer...250 Kva, 2300. 115 230 volt, single phase, 60 cycle.

Design typical of ratings up to 50 Kva inclusive. High and low voltage terminals can be arranged for housing with switch and fuses as specified.



By locating this distribution transformer near the load cente costly runs of low-voltage wiring are saved. Many Standar Transformers are now furnished with switching equipme installed in an attached cabinet as shown above. Be Askarel-Cooled, it is safe anywhere.

For Every Class of Service **THE STANDARD**

Makers of: POWER, DISTRIBUTION, RURAL, INSTRUMENT, STRE

OUR INSTALLATION PROBLEMS

ASKAREL*-COOLED

Transformers

* ASKAREL, a non-inflammable, non-explosive liquid is approved by the Underwriters Laboratories to be used as an insulating and cooling medium. The National Electric Code allows Askarel-filled transformers to be installed indoors without fireproofing. Write for Bulletin S-101.

2500 Kva. three phase, Askarel-Cooled Standard Power Transformer. Years of user experience has proved the economy and dependability of Standard Askarel-Cooled Transformers.

RANSFORMER CO. WARREN, OHIO

GHTING AND TESTING TRANSFORMERS . . . OIL, ASKAREL OR AIR COOLED

STYLE "B"
With gasketed flange for mounting on boxes.

The years of trouble-free service has created a wide acceptance of G & W Type "FC" Oil Fuse Cutouts. The modern design provides interchangeability of parts for various installation conditions. The interlocking cover and cover clamp insures safety in fuse replacement. The simple and inexpensive fuse link universally fits all Type "FC" cutouts.

½ cycle interruption of short circuits protects equipment.

Beryllium copper springs make ideal full load break switching contacts.

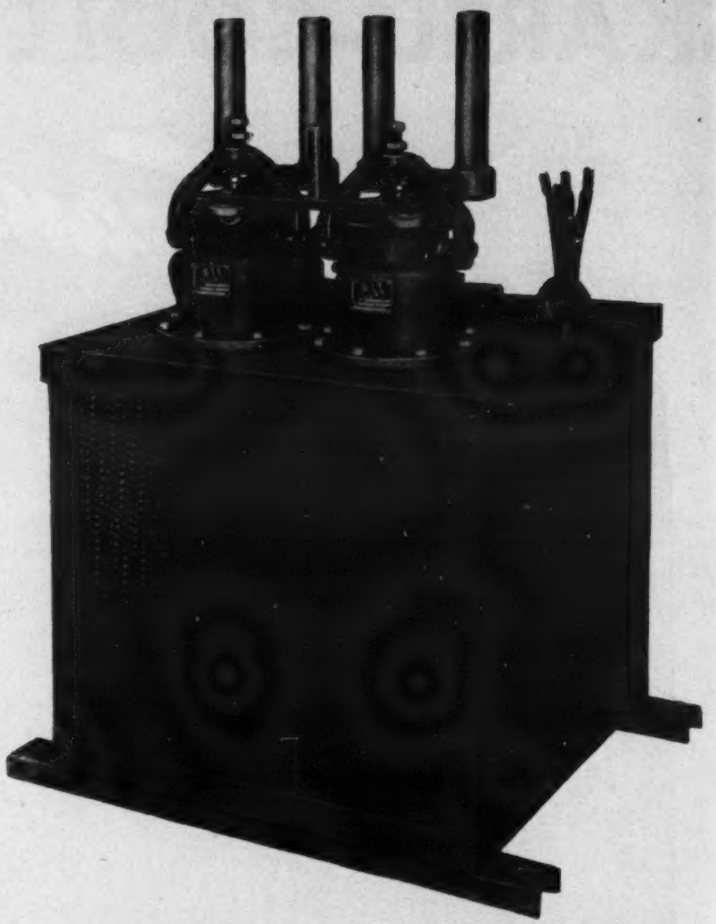
Save Installation Labor

By Specifying

G & W TYPE "FC" OIL FUSE CUTOUTS

on your transformers

FULL COOPERATION WITH TRANSFORMER MANUFACTURERS IS ASSURED



The Standard Transformer Co., Warren, O. dry type transformer—Type MG, 25 Kva., single phase 2400 volt. Equipped with G & W No. FC31B oil fuse cutouts.

Secure the advantages of complete unit metal enclosed construction with CUT-OUT BOX attached to the transformer.

Installation labor is reduced by merely terminating the feed cables in potheads (*also made by G & W*) or within the cut-out insulators inside the box. Conduit connections can be made on the pothead or directly on the box.

An economical primary load-break oil switch with overload and short circuit fuse protection.

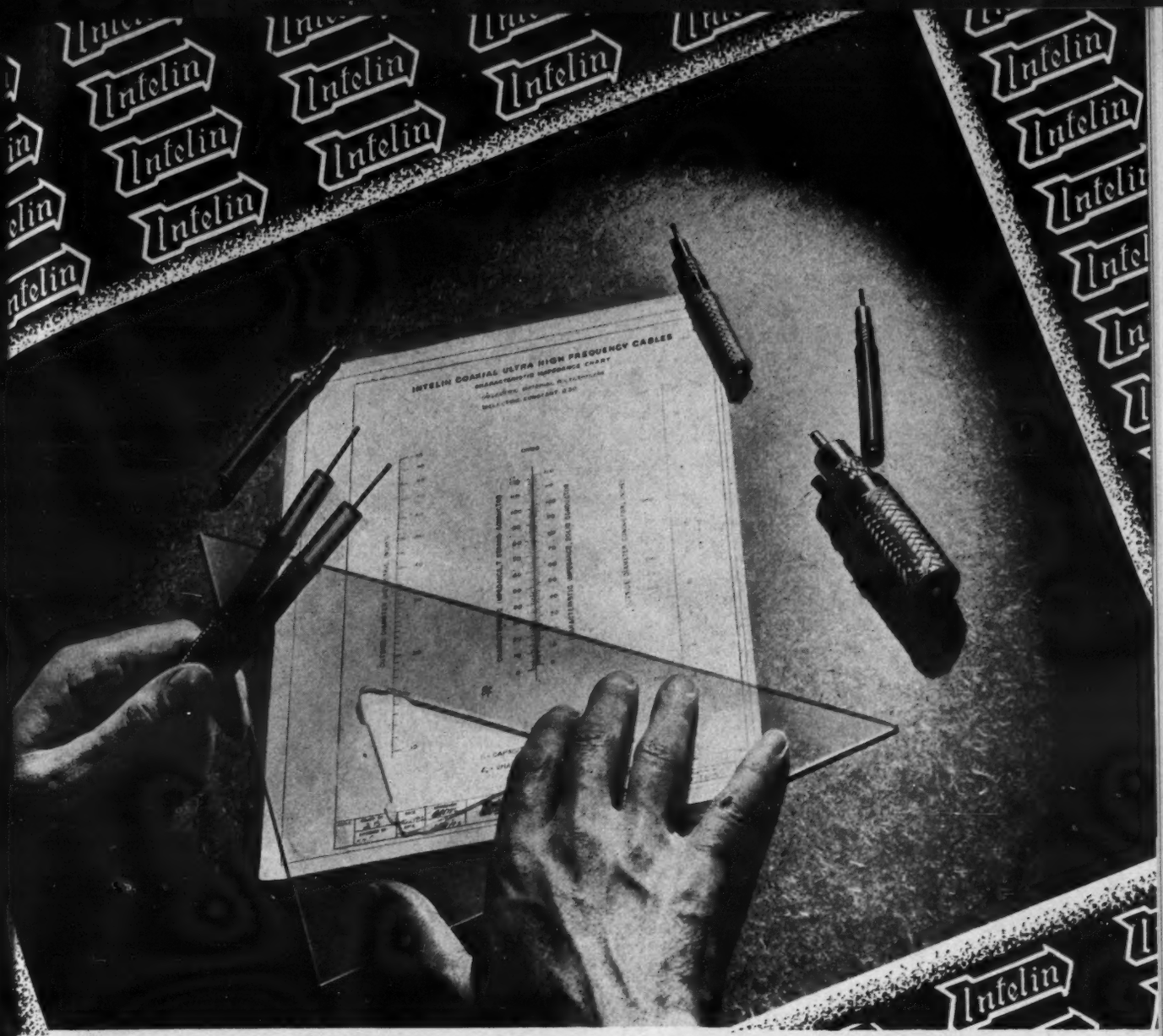
Send for Bulletin 425

G & W ELECTRIC SPECIALTY CO.

7780 DANTE AVENUE • CHICAGO 19, ILL., U. S. A.

In Canada—Powerlite Devices, Ltd., Toronto

GANG OPERATED } FOR FUSING AND SWITCHING PRIMARY CIRCUITS SUBWAY – OVERHEAD – VAULTS



HOW BIG A CABLE?

The impedance characteristics of Ultra-High Frequency Cables are dependent on the physical dimensions — the size of center conductor and the inside diameter of the coaxial braid.

You can easily determine impedance by the use of this Intelin Chart. Apply a straight edge, with the crossover at the desired impedance on the center scale. The other two scales then indicate, for any scale position, the corresponding conductor size and dielectric size necessary for the desired impedance.

BUY MORE BONDS

Federal, long recognized as a manufacturer of better vacuum tubes, now leads with new production methods resulting in still greater tube efficiency and length of life. Everywhere, it's Federal tubes for superior transmitting and industrial power performance.

A full size copy of this chart is yours on request. Write for it today!

Remember, Intelin Cable is more than insulated wire — it is specialized transmission line — made with watchmaker accuracy.

In the Intelin Cable family there is a type to match your ultra-high-frequency problems, a cable balanced in all electrical properties to do your job.

INVEST IN THE FUTURE

Federal Telephone and Radio Corporation

AN IT&T ASSOCIATE

Newark 1, N. J.

The entire family of ALCOA ALUMINUM BUS BARS *is at work here—*

High in electrical conductivity, light in weight, corrosion-resistant, easy to handle; the designers took full advantage of these properties of aluminum in this industrial outdoor substation. Alcoa Aluminum bus bar shapes—channels, angles, flats and rounds—enabled them to meet all mechanical requirements most economically.

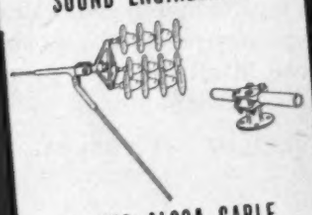
Vital wartime electrical loads are being carried by Alcoa Aluminum bus bars in every type of industry. Generating plants and substations, mills and factories, office buildings, battery rooms in telephone and telegraph systems; all are being supplied with power by these efficient, easy-to-maintain bus bars.

Now that the supply of aluminum exceeds the demands for military uses, Alcoa Aluminum bus bar shapes and fittings are again available. WPB Order M-1-i now permits the use of aluminum for electrical conductors. Users will find that, in installing aluminum bus bars, fewer man-hours are required. The lighter weight of aluminum makes transportation, handling and erection easier.

If you are considering the installation of new bus bars, or the extension of an existing system, consult Alcoa.

Our engineers are anxious to serve you. Write ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh 19, Pennsylvania.

SOUND ENGINEERING



MAKES ALCOA CABLE AND BUS FITTINGS RELIABLE

ALCOA
ALUMINUM

e yours, our first job is to do all we can to speed production. So, if you need steel, steel prod-, machinery and equipment, we'll get it to quickly if at all possible—subject to priority uirements. A call to us has broken many a duction bottleneck — helped speed many a order.

ven today, our stocks are large. They include tional Emergency Alloy Steels, which have ved so successful. Try us. We welcome your uiries. Phone, write or wire our nearest ehouse.

For Welding Needs

can supply Welding Wire, for electric arc welding, as:

STAINLESS STEEL ELECTRODES
HARD-SURFACING ELECTRODES
MILD CARBON ELECTRODES

e also offer Welding Machines, Protect-O-Metal limination of weld spatter and Havens "C" Pro-d Clamps. Write, phone or wire our nearest ehouse.

UNITED STATES STEEL SUPPLY COMPANY

9 CONVENIENTLY LOCATED WAREHOUSES

CHICAGO (90),	1319 Wabansia Ave., P. O. Box MM	Teletype CG. 605	BRunswick 2000
BALTIMORE (3),	Bush & Wicomico Sts., P. O. Box 2036	Teletype BA. 183	GILmore 3100
BOSTON (34),	176 Lincoln St., Allston, P. O. Box 42	Teletype BRTN. 10	STAdium 9400
CLEVELAND (14),	1394 E. 39th St.,	Teletype CV. 153	HEnderson 5750
MILWAUKEE (1),	4827 West Scott St., P. O. Box 2045	Teletype MI. 587	Mitchell 7500
NEWARK (1), N.J.,	Foot of Bessemer St., P. O. Box 479	Teletype NK. 74	Bigelow 3-5920
		REctor 2-6560	· BErgen 3-1614
PITTSBURGH (12),	1281 Reedsdale St., N. S.	Teletype PG. 475	CEdar 7780
ST. LOUIS (3),	21st & Gratiot Sts., P. O. Box 27	Teletype SL. 384	MAin 5235
TWIN CITY,	2545 University Ave., St. Paul (4), Minn.	Teletype STP. 154	NEstor 2821

UNITED STATES STEEL SUPPLY COMPANY
USS
STEELS
SERVICE

UNITED STATES STEEL

EC&M LINE-ARC
CONTACTOR CONTROLLERS IN THE 8th Year of Successful Operation ON THIS PLATE MILL

Single push button controls rolls to Pre-set Drafts.

Partial view of TIME-CURRENT Controllers serving this mill.

WITH this mill operating on an accelerated schedule—possibly two to three times that of normal years, due to war-time demands—these EC&M LINE-ARC Contactor Controllers have established new records in low maintenance costs and time-outs.

Selected in 1936 for the operation of hard-worked drives on this 100" Plate mill such as screwdowns, side guides, etc., this EC&M Control installation is operated automatically through Pre-set Drafts and has resulted in high production of accurately finished products.

Our nearby office will be glad to explain the merits of LINE-ARC Contactor Controllers and Automatic Pre-set Control.

OUTSTANDING FEATURES OF LINE-ARC

1. Cool operation insures long contact-life.
2. Control of the arc prevents destructive burning of arc shields.
3. High-speed operation permits quick response—accurate moves.
4. Continuous capacity operating coils.
5. Long bearing life with nitralloy pins and self-lubricating bearings throughout.

THE ELECTRIC CONTROLLER & MFG. COMPANY

2698 E. 79th STREET — CLEVELAND 4, OHIO

YOU WOULDN'T HAVE WANTED IT ANY OTHER WAY

Billions of feet of "U. S." wires and cables have been shipped to our fighting fronts . . . wires and cables badly needed by you here at home . . . but indispensable to our Armed Forces.

Much of that huge output was Laytex Wires and Cables, in heavy demand on the domestic front. But you understood . . . you did not question the right of our Army and Navy to every foot of it.

It was natural that Laytex should be required for many military services — communication, signaling, data transmission, searchlight and gun control. For Laytex is an unusual wire development. It is lighter and more

flexible than any other wire of the same capacity. It is especially valuable for military uses in swamps, deserts, rough terrain — even under-water services.

The men and women of the Bristol, R. I. plant of the U. S. Rubber Company, makers of Laytex Wires and Cables, have been given the Army-Navy "E" for a job well done. In expressing appreciation to them we are not unmindful of the share you, our customers, have had in this effort . . . you who have so willingly set aside plans and made the best of it, until Laytex is again available. In the final analysis, you wouldn't have wanted it any other way.

SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

1230 Sixth Avenue • Rockefeller Center • New York 20, N. Y. • *In Canada:* DOMINION RUBBER CO., LTD.

Listen to the Philharmonic-Symphony program over the CBS network Sunday afternoon, 3:00 to 4:30 E.W.T. Carl Van Doren and a guest star present an interlude of historical significance.

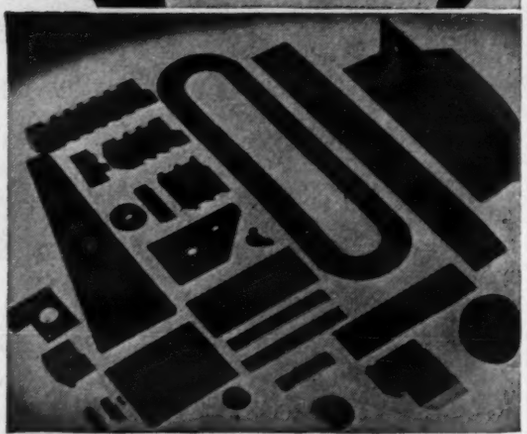
LIGHTER weight, greater speed, higher safety standards, longer life, lower travel and transportation costs . . . have been the lengthening shadows which have forecast our modern methods of overland transportation.

One C-D product, DIAMOND Vulcanized FIBRE, early presaged revolutionary design changes. DVF is a tough, strong NON-metallic, with an extremely favorable, strength-weight factor when compared to metals. It has a natural resilience and great ability to absorb shocks and vibration. It is a good electrical insulator. It is readily punched, machined or formed.

In 1911 C-D introduced DILECTO, a laminated plastic, first called "waterproof fibre." DILECTO has played an equally important part in helping advance transportation methods. Wherever electricity must be controlled C-D DILECTO provides insulation that stands up under extreme conditions of temperature and moisture.

In adapting these and the other C-D NON-metallics to the "What Material?" problems of peace and war, the C-D laboratory has acquired a wealth of "know how" which is at your disposal to help you solve your "What Material?" problem.

DISTRICT OFFICES: New York - Cleveland - Chicago - Spartanburg, S. C. West Coast Rep., Marwood, Ltd., San Francisco - Sales Offices in principal cities



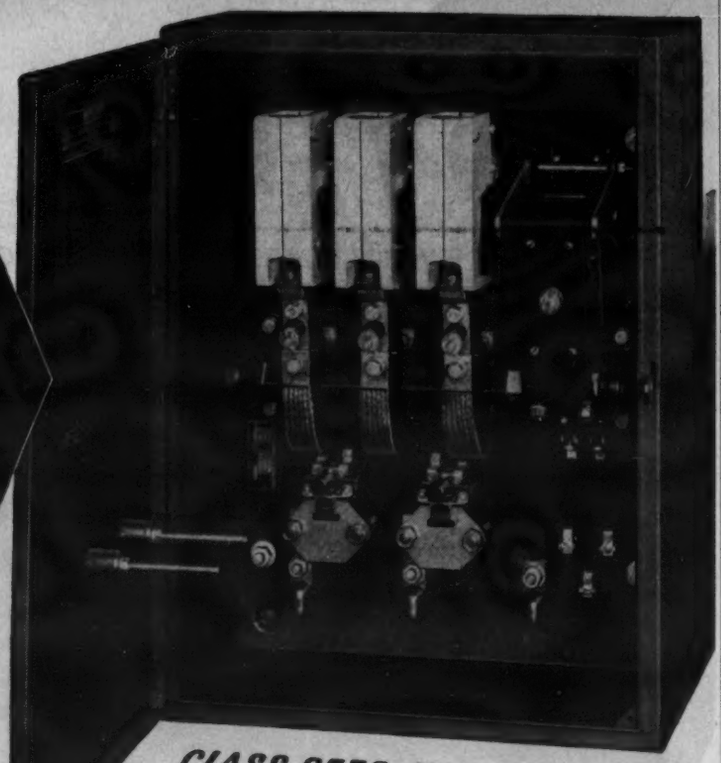
C-D products include THE PLASTICS . . . DILECTO—a laminated phenolic: CELORON—a molded phenolic: DILECTENE—a pure resin plastic especially suited to U-H-F insulation . . . THE NON-METALLICS, DIAMOND Vulcanized Fibre: VULCOID—resin impregnated vulcanized fibre: and MICABOND—built-up mica insulation. Folder GF describes all these products and gives standard sizes and specifications.

C3-43

Continental - Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911—NEWARK 15 • DELAWARE

AN *Improved* SIZE 4 STARTER WITH FIVE NEW FEATURES



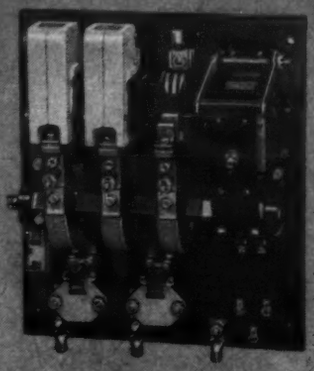
CLASS 8536 · TYPE VG-2

---SMALLER-QUIETER----

1. Improved blow-out coils have fewer turns and are wound with heavier copper—assuring less heating effect, and efficient interruption of stalled rotor currents for electric motors up to 100 horsepower.
2. New and larger magnet of modified **"E"** type construction gives added efficiency.
3. Self-aligning, floating armature eliminates vibration noise—reduces heating and magnet wear.
4. New shading coil affords exceptional mechanical strength. This coil is held in place by the magnet coil in such a manner as to prevent its falling out. Use of heavy brass ribbon makes shading coil virtually unbreakable.
5. Narrower panel saves space and flat door cabinet permits gang mounting.

• • •

This greatly improved Type V device is available in a complete range of enclosures for all Size 4 starter applications, including reversing, combination, multi-speed, reduced voltage, etc. Call in or write your nearest Square D Field Engineer for complete information.



Open type starter panel with one arc chute removed to reveal contacts and blowout coil.

Side view of panel shows "E" type magnet, floating armature and new shading coil.

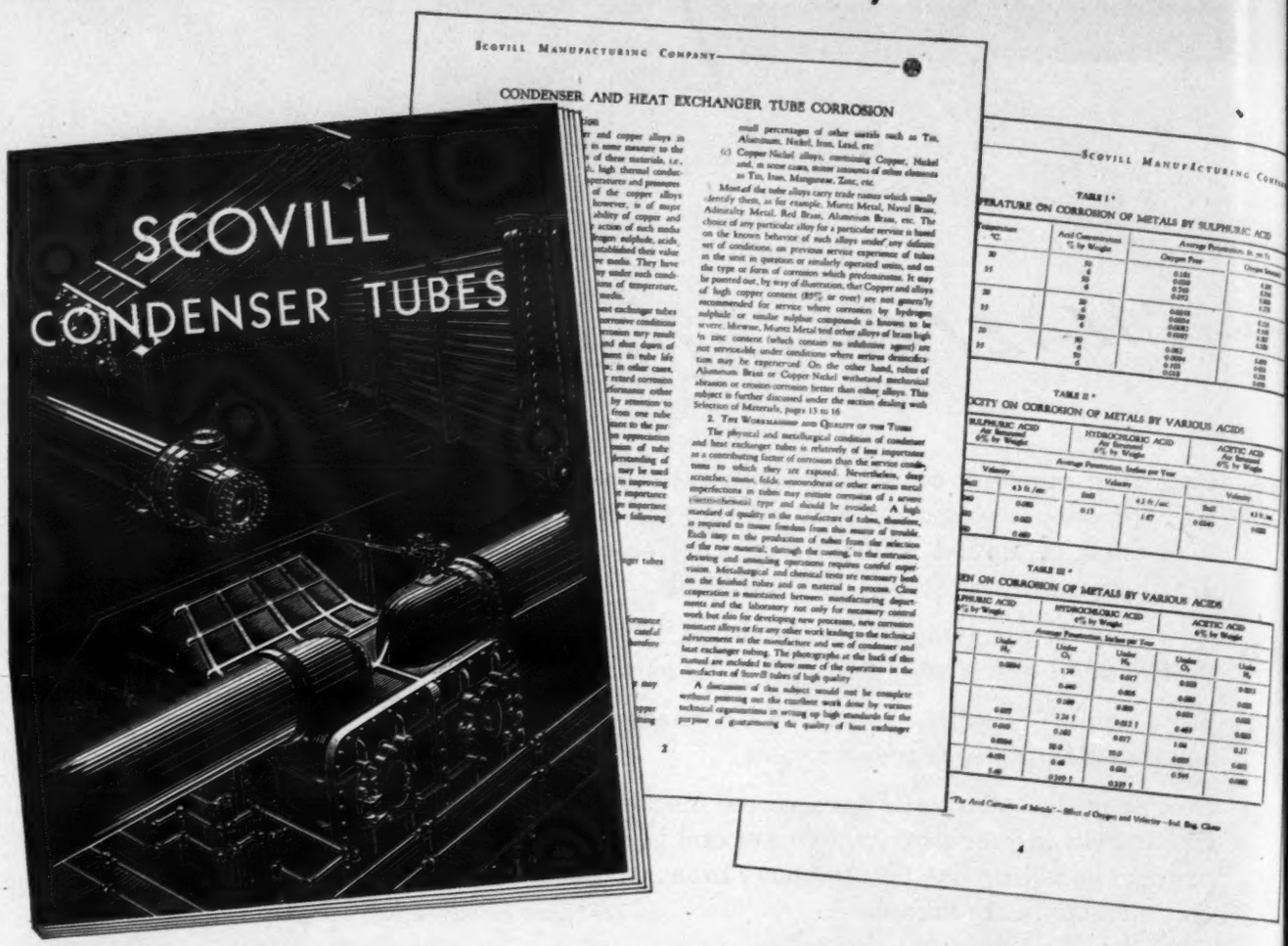
SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

Scovill Tube News

Vol. 2 SCOVILL MANUFACTURING COMPANY, Waterbury 91, Conn No. 5

New Scovill "Condenser Tube Booklet" Gives Facts On Selection, Installation



Corrosion

The booklet has a color illustrated section on corrosion, as it affects condenser and heat exchanger tubes. Gives the factors that influence tube life — from alloy composition to service conditions. Discusses the six important types of tube corrosion and the corrodants involved. Amplifies on *stress, season* and *corrosion-fatigue* cracking.

Composition of Tube Metals

A separate chapter deals with the composition and physical properties of tube metals such as: Muntz Metal, Admiralty Metal, Phosphorized Admiralty, Red Brass, Deoxodized Copper, Arsenical Copper, Aluminum Brass, 70–30 Copper-Nickel, and 80–20 Copper-Nickel. It gives their nominal composition and the when, why and where of their use in condenser-tube and heat-exchanger fields.

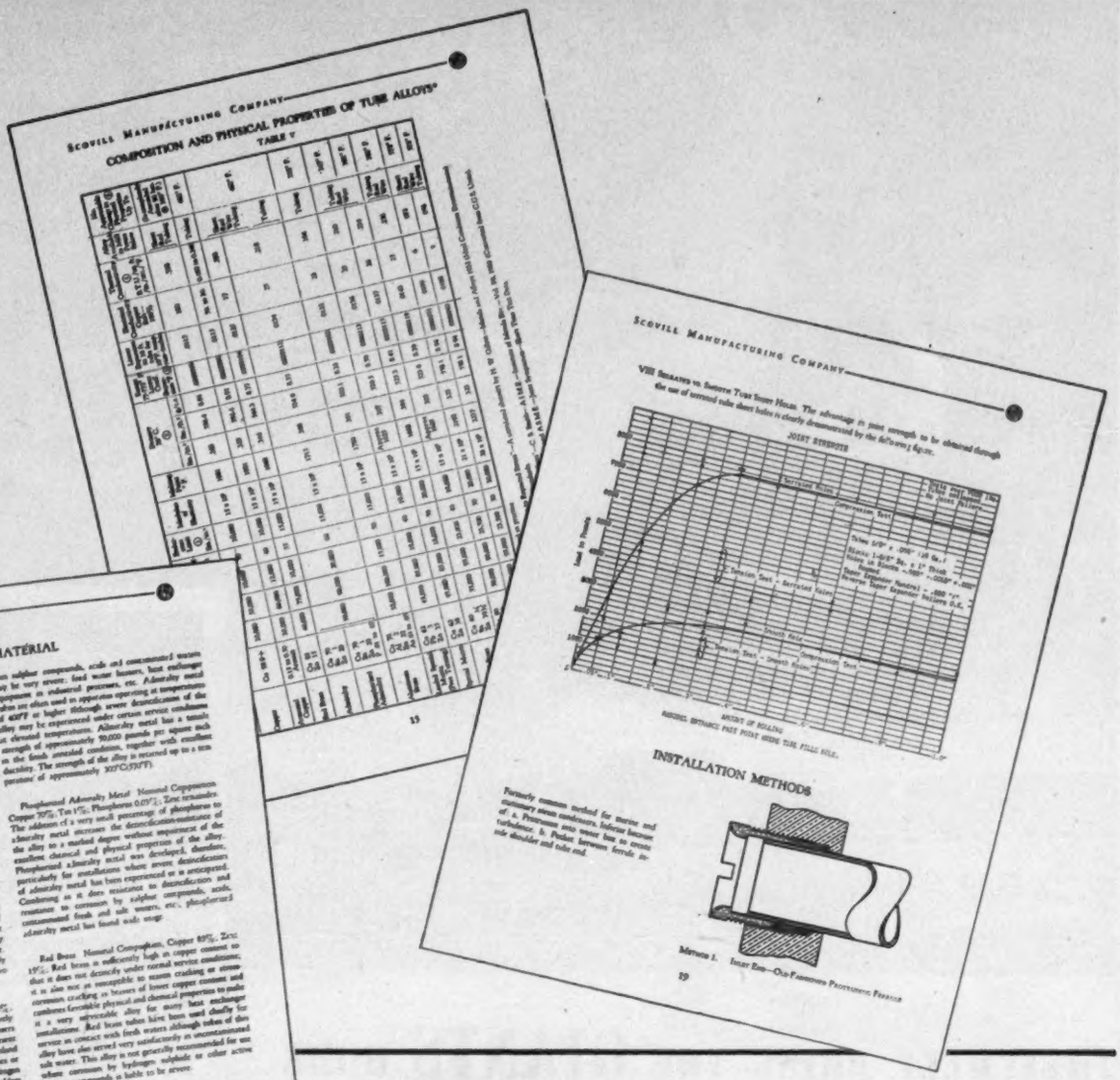
In this new booklet of tube facts, Scovill engineers have compressed a brief of many years of tube experience into some 56 pages. The result is a practical and understandable handbook that tube users will find useful.

Tube Installation

Another section concerns the importance of proper installation, methods of installation, the proper tools. Adequately illustrated with photographs, diagrams, charts and data tables.

Production Methods

Scovill explains the detail of the processes used in tube manufacturing. Thirteen full-page photographs give a good understanding of these processes.



ARMY NAVY

THIS IS NUMBER ELEVEN in a Series of Scovill Advertisements to help you get longer life from condenser and heat exchanger tubes.

In Conclusion

Scovill's new "Condenser Tube Book-" provides useful reference pages on auge Sizes, Inch Conversion Tables, emperature Conversion Tables, Per ot Weights of Scovill Condenser ubes, Weights of Common Scovill loys, Pertinent Formulas and Physical onstants, Heat Unit Terms and Defi-ions and Conversion Factors with eir definitions.

Other Scovill Services

It is by means such as this that Sco-ll renders its *Service in Manuals.* ther Scovill services include *Service in letals* and *Service in Men.* The first akes the complete laboratory facilities Scovill available for the determination of the alloy best suited to your needs. The latter gives you close cooperation from Scovill engineers in planning proper installation or investigation where necessary. Scovill Manufacturing Co., 24 Mill Street, Waterbury 91, Conn.

Scovill
MANUFACTURING COMPANY
WATERBURY, CONN.

SCOVILL CONDENSER TUBES

ONE PRODUCT... THREE SERVICES

Service in Manuals... Service in Metals... Service in Men

Years ago motor and generator brushes had copper strips or wire bristles to conduct electricity from stationary to rotating parts—that's how they got their name. Carbon is now the material for all sizes of these brushes.

THEY HELP BRING THE GIANTS HOME

ONE OF the "little things" that are contributing greatly to the safety and welfare of our fighting men, is a special kind of carbon brush used in high-altitude planes. These brushes are essential to the generators and motors that supply energy for the radios, firing apparatus, gun turrets, bomb bay doors, landing gear, and other equipment of the planes. A heavy bomber has more than 40 of these devices requiring brushes.

Ordinary brushes disintegrate in a few minutes at altitudes where the air is "thin" and dry. A brush that would be dependable from take-off to ceiling and would have a life of 100 hours or more—had to be found. It came from the laboratories of NATIONAL CARBON COMPANY, INC., a Unit of UCC.

Carbon is useful in many other ways to Americans at war. Therapeutic lamps, which employ the carbon arc, are helping to restore health to sick and wounded men. Activated carbon in gas masks, by absorbing toxic vapors, is ready to save lives.

In the two-way radio telephone—the walkie-talkie and the handy-talkie—and in hearing aids for the deafened, carbon has another role. Carbon is essential in the small, powerful batteries that are used in these devices.

▼

Teachers, designers, and operators of electric motors, generators, and rotary converters are invited to send for "Modern Pyramids." This is a series of pamphlets containing practical suggestions on the performance, characteristics, operation, and application of carbon, graphite and metal-graphite brushes. Write National Carbon Co., Inc., Cleveland 1, Ohio, Dept. 16-G.

★ BUY UNITED STATES WAR BONDS AND STAMPS ★

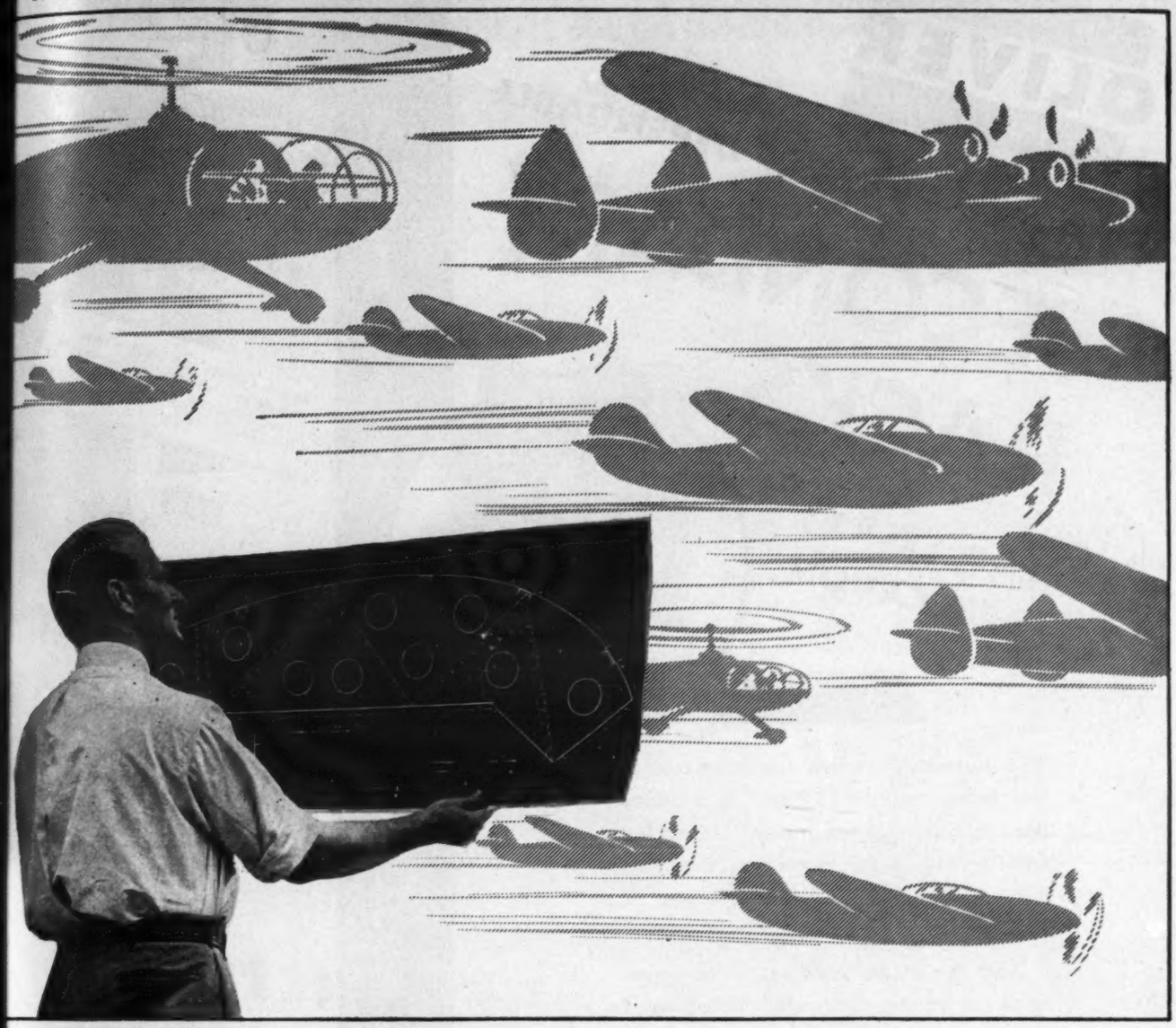
The trade-mark "National" distinguishes products of National Carbon Company, Inc.

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide and Carbon Corporation

CARBON PRODUCTS DIVISION, Cleveland 1, Ohio UCC New York, Pittsburgh, Chicago, San Francisco

NUMBER 11 IN A SERIES, TRACING FIFTEEN YEARS OF KELLETT AIRCRAFT HISTORY ★



Giving Wings to Production

RESOURCEFUL aeronautical engineers, striving to find ways to speed output for war, are bringing about many revolutionary manufacturing developments. Later these will contribute also to America's peacetime progress.

Among recent developments is the unique Kellett Loft Reproduction Method. One of the Vinylite negatives is shown above. This new Kellett service, available to all industry, is helping to speed war production from drawing boards to fighting fronts by reducing costly tooling-up time. It is contributing, too, to the development of Kellett HELICOPTERS for our armed forces. It is but one example of Kellett engineering resourcefulness.

With the coming of peace Kellett's aeronautical design and production facilities will be devoted to supplying helicopters for a wide variety of commercial and industrial uses.

Because this type of aircraft can take off and land without forward flight, can fly speedily—or hover in mid-air—indications are that Kellett Helicopters will then serve and save in the inspection and patrol of electric power lines, and oil pipe lines, in prospecting, in forest fire control, in ranching, in the dusting and spraying of agricultural crops . . . and many more civilian applications. Kellett Aircraft Corporation, Upper Darby (Philadelphia), Penna.

KELLETT

OLDEST ROTARY WING AIRCRAFT MANUFACTURING COMPANY

from the COMPLETE LINE OF

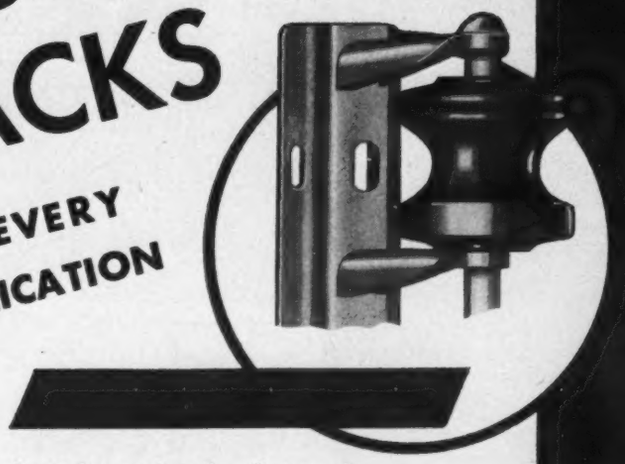
OLIVER

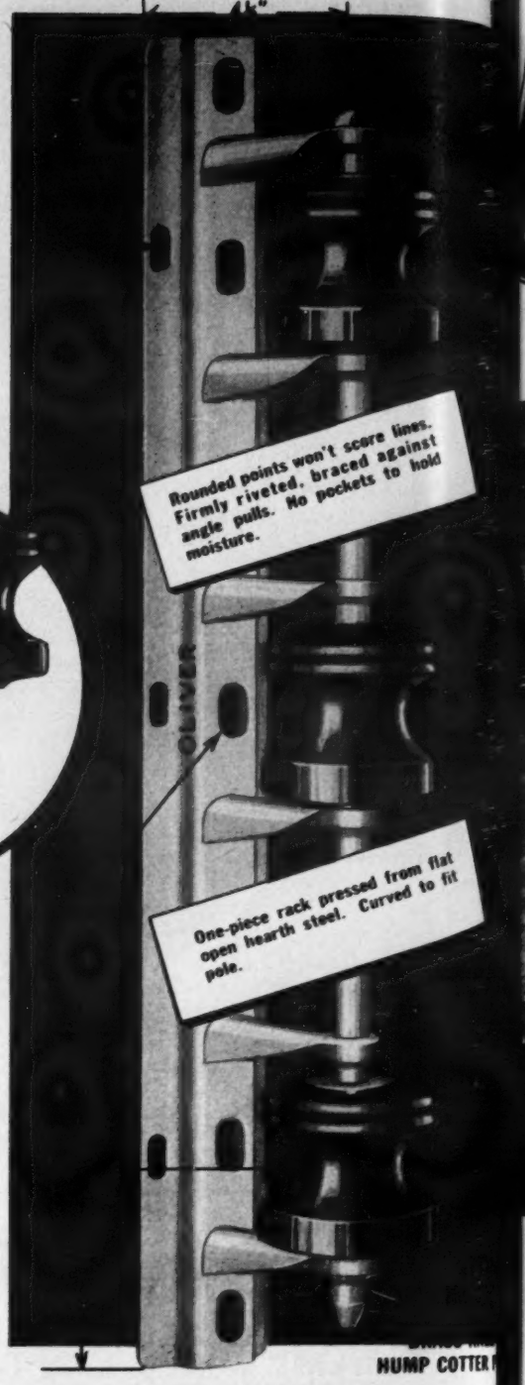
POLE LINE MATERIALS

SERVICE-PROVED, DEPENDABLE

SECONDARY RACKS

FOR EVERY APPLICATION




Rounded points won't score lines. Firmly riveted, braced against angle pulls. No pockets to hold moisture.
One-piece rack pressed from flat open hearth steel. Curved to fit pole.
OLIVER
HUMP COTTER

The illustration shows details of one of the more popular Oliver Secondary Racks. Other styles include racks for two, three and four wires; spacings 4 to 12 inches; types for heavy, medium or light service.

Note the many practical advantages, such as rounded, riveted points and one-piece back. Heavy hot-dip galvanizing provides complete protection.

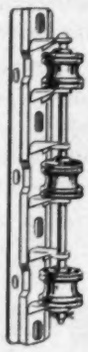
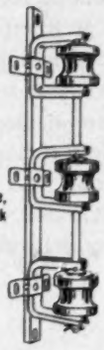
Insulators are dry-process brown glazed porcelain designed for high mechanical and electrical values. Packed in heavy cardboard cartons for safe shipment.

Oliver Catalog 43 contains full information on Pole Line Materials. Have you a copy?

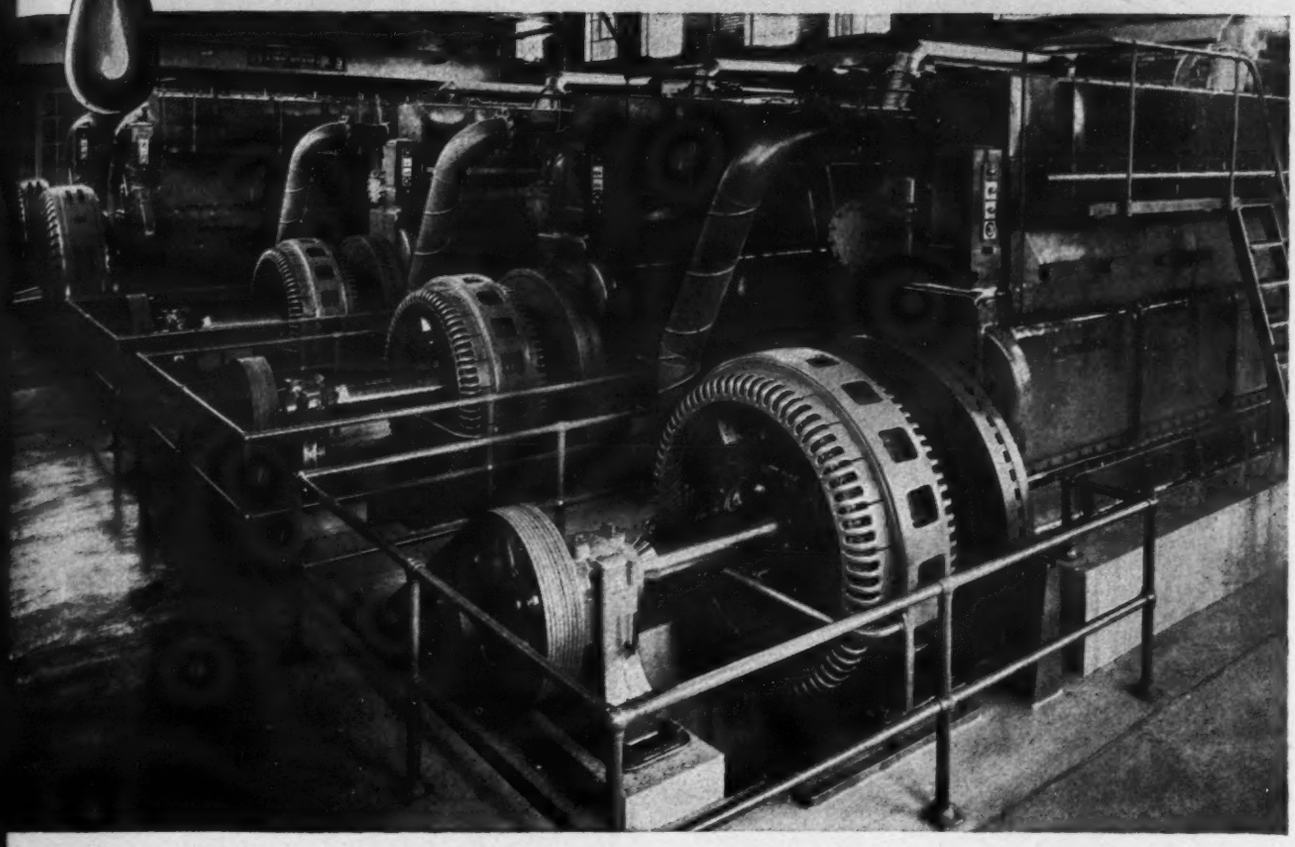
OLIVER
IRON AND STEEL
Corporation

Makers of Pole Line Materials Since 1894

PITTSBURGH, PENNSYLVANIA

LIGHT SERVICE	RURAL	HOUSE RACKS
		
2338 Same general construction as No. 2238 (above) except lighter throughout	**4338** Because little inspection is needed over extended periods of time, this Oliver rack is popular for Rural work.	**2636** Oliver makes a complete line of House Racks, as well as many other types of racks for special services.

CORRECT Lubrication means *Better Maintenance*



PROBLEM—excessive wear, difficult maintenance.

SOLUTION – *Correct* lubrication.

For *correct* lubrication of Diesels, Sinclair provides both RUBILENE and GASCON OILS to meet the different requirements of various types of engines.

These oils are non-gumming and highly sludge-resistant. They seal compression, reduce ring wear, and give *safe* lubrication under continuous heavy loads.

Is maintenance a worry? Let us tell you how Sinclair lubricants make for *better maintenance.*

(Write for "The Service Factor"—published periodically and devoted to the solution of lubricating problems.)

SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

Have You Seen It?

THIS new postwar, general purpose Fairbanks-Morse Motor is available to industry now.

Never before have there been more stamina—more protection—more versatility—built into a motor housing.

You'll have to see it demonstrated to appreciate fully how much this motor can really offer you.

BUY WAR BONDS

Look at These Features!

- ★ It is a 40°C. motor.
- ★ It is a protected motor.
- ★ It has an optional conduit box assembly.
- ★ It has cross-flow ventilation.
- ★ It has ball bearings—sealed-in and protected.
- ★ It has the exclusive Fairbanks-Morse COPPERSPUN ROTOR.

Write for detailed information. Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

FAIRBANKS-MORSE

DIESEL ENGINES
PUMPS
MOTORS
GENERATORS
WATER SYSTEMS
SCALES
STOKERS
FARM EQUIPMENT
RAILROAD EQUIPMENT

Motors

War News from Italy

—broadcast by the

Transmitter you might have had!

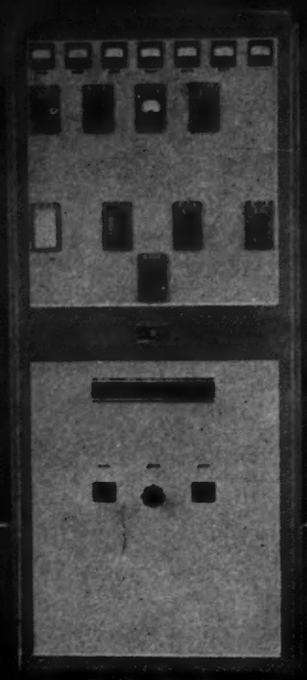
When the Allies invaded Italy the War Department asked RCA Communications, Inc., to build and operate a complete new radio station in Italy.

Men and material were rushed overseas to the Italian site. Night and day RCA engineers labored — the flash of big guns lighting the night horizon.

In 43 days the new station ICA was on the air. On February 1 it began sending America spot news from the Italian front. A notable transmission was the first broadcast from the Anzio beachhead (which was picked up from a low-power transmitter on the beachhead and relayed directly to the U.S. by Station ICA).

The two transmitters installed at ICA are RCA Police Transmitters — the type employed for emergency communications in many American communities. Except for the war your community might be using one of these very transmitters today.

This incident may help you to understand why RCA cannot supply equipment for civilian emergency communications requirements now. But when this war is over, RCA will be in a position to furnish better equipment than ever before. Moreover, RCA engineers will help you right now to plan an effective emergency communications system for postwar installation.



RCA Transmitter used by station ICA

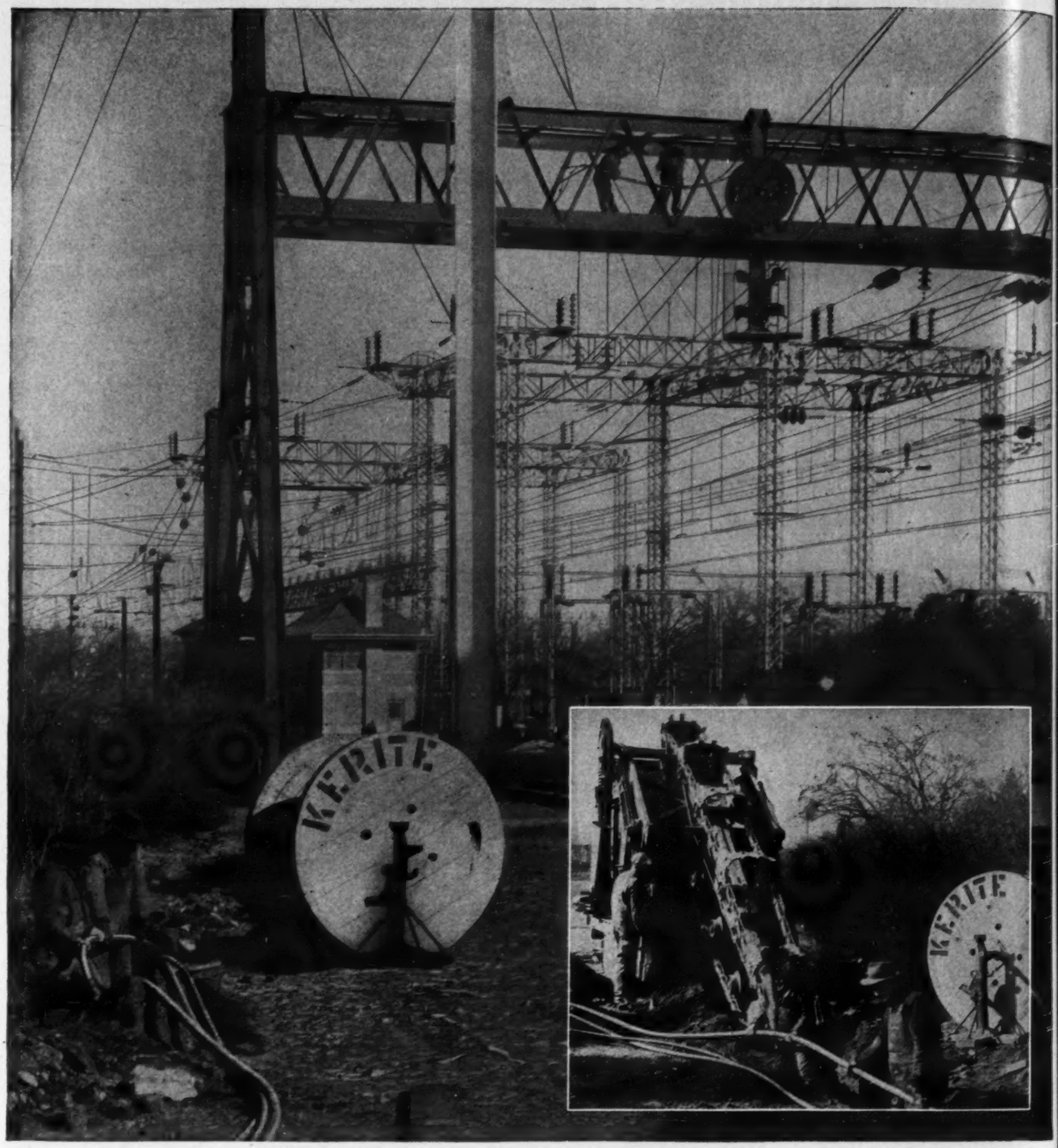
RCA

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION · CAMDEN, N. J.

LEADS THE WAY.. *In Radio .. Television .. Tubes .. Phonographs .. Records .. Electronics*

Pioneers in Cable Engineering



SOUND CONSTRUCTION METHODS are an important contribution to the operating integrity of Kerite buried cables.

THE KERITE INSULATED WIRE & CABLE COMPANY INC

NEW YORK CHICAGO SAN FRANCISCO

Electrical World
JULY 22, 1944

National Thinking

LDING COMPANIES, as this industry has ne to know them, are gradually shortening ir shadows. How long it will be before they have been reduced virtually to the status of rating companies through the application of Holding Company Act is anybody's guess, the tide is very strong right now.

Many an operating company executive has hed for the day when he was free of parental ection and could stand on his own two feet make his own decisions. Some of them e had their wish and there will be many re in the months to come. How many of these n are going to be ready when their time nes?

The holding company, as some emancipated cutives have already found out, did con- bute much to local operations that was very uable. Not the least of these contributions integrated or national thinking. When the ding company steps out of the local picture, most instances this is lost. How is it going be replaced?

The local executive who has been under the tection of a holding company for a long time for the most part been content to devote self to his own operating problems, leaving se matters outside his area to the parent com- y. When he gets his freedom the operating npany executive will find that his area of ponsibility has greatly increased and that re are a lot of national problems that affect operations to a greater or lesser degree. He l find also, however, that his previous train- has not always been such as to enable him er to recognize many of these national prob- lems in their early stages or to know how to handle them. He is going to need help.

So far most problems of national import have had to deal with legislative, regulatory or government power expansion matters. However, there are operating problems also, which sooner or later will require solutions at the national level. One of these that right now is in the making is that pertaining to organized labor. Working conditions, job classifications, pay differentials and such will not always have to be worked out in each case as an entirely local matter. Management and labor some time must confer about their mutual interests in the future and define what each is willing to contribute.

To do these things, however, requires a kind of thinking that recognizes a problem as being national and that is willing to work out a solution that will benefit the industry nationally even if it does interfere with some local situations. In other words, the process of disintegration, which is resulting from the application of the Holding Company Act, needs some offsetting integration.

The first place one looks for that integration in other industries is in their national trade associations. That it isn't available to a greater degree in the several national electric utility associations is unfortunate. However, official association recognition has been taken of the matter and it is hoped that a practical and acceptable solution will be found that can be put into operation reasonably soon.

Localized ignorance and fear, which have prevented unified action, must give way to a realization of the greater good that can come from national solidarity.

Rail Power Trains for War Theaters

American manufacturers collaborate to provide 34 steam plants on wheels—Burn low-grade fuel and use air-cooled condensers—Boilers fed by spreader-stoker—Preheater for Stoker-drive engine

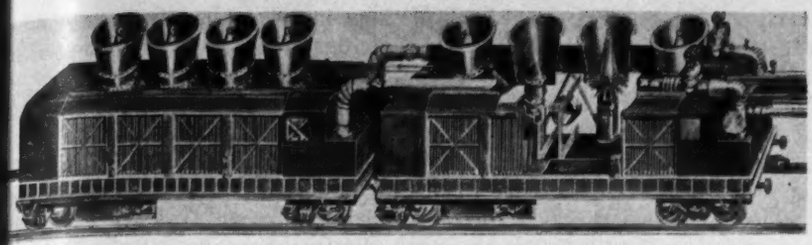
TWENTY-FOUR 1,000-kw. and ten 5,000-kw. portable, self-contained steam electric power plant in the form of "Power Trains" are being built by Westinghouse Electric & Manufacturing Co. for use in the European and Asiatic war theaters. These will supply essential power for military and rehabilitation purposes where the local facilities have been destroyed in combat or by enemy demolition. They are assembled in specially designed railway cars which, with suitable trucks, can be transported over most American and some foreign railroads, and can be operated to generate electric power when located on satisfactory railway sidings and provided with necessary supplementary foundation supports. Full output rating is to be produced when using low-grade lignite fuel with approximately 7,300 B.t.u. 22 percent ash and 24 percent moisture.

5,000-kw. Power Train

The specification requirement that the power plant operate with a minimum loss of water made it necessary to use a closed steam cycle and air cooled condensers. Space and weight limitations, and reliability were important factors in determining the steam conditions for the 5,000 kw., 3,000 r.p.m. prime mover to be 600 lb./sq. in. gauge and 750 deg. F. at the throttle, and exhausting at 2 lb./sq. in. gauge. Under these steam conditions the Westinghouse turbine generator will require 80,000 lbs. of steam per hour to produce a gross generator output of 5,000 kw. Space limitations, steam production requirements, and the low grade fuel for the furnaces fixed the type and number of boilers, super heaters, economizers and other steam generating auxiliaries.

Eight railway cars of the freight type and approximately 50 ft. long are required to house and support the main and auxiliary power plant equipment. The framework of each car is designed to meet the loadings of the

FIRST of 5,000-kw. Allied power trains on test viewed from coal tipple. In the foreground, end of one of the two boiler cars, next the water storage tank, and the auxiliary-power car. At the pole is the turbogenerator car and then come two air-cooled condenser cars



WO CARS house the air-cooled condensers of the rail power trains

uipment located in the particular r. All cars have double walls for all posed surfaces with thermal insula- on placed in the inter wall space. he cars were designed and built by e General American Transportation orporation at East Chicago.

Air-Cooled Condensers

Main steam condensers are novel in at air is used as the cooling medium. ch designed to condense the exhaust om the 5,000-kw. turbine at a maxi- um back pressure of 2 lbs. per uare inch gage, when cooled by air temperature from minimum 40 g. F. to 95 deg. F. The prime func- on of the condenser is the recovery condensate.

It is imperative that steam be sup- ied to all the cooling surface; oth- wise under extremely low ambient nditions ice will form on the idle eas leading to blocked and eventu- ly ruptured tubes. Eight condensing ctions are installed on each of two rs. Four blowers on each car draw e air from the outside through the ndenser to a plenum chamber at the nter and then discharge it upward. ch condenser car is equipped with single stage ejector and an air- oled after-condenser.

The following statistical informa- on applies to these air-cooled con- nsers:

Total Fin Surface...	90,000 sq. ft.
Total Tube Surface..	10,500 sq. ft.
Cooling Air Through Condenser	800,000 c.f.m.
Steam Condensed...	80,000 lbs./hr.
Tube Material.....	Galvanized Steel
Temperature Rise of Air Through Conden- ser at Full Load.....	90 F.

By dividing the tubes into groups d putting an orifice in series with ch group, a small over-supply of eam to each group will put the con- olling pressure drop at the orifice ther than across the tubes, and the ndency toward poor steam distribu- on is damped out. The usual prac- ce of putting the air cooler at the oldest part of the condenser is re- versed here to prevent freezing.

The main turbine is rated at 5,000 kw. and is designed for using steam at the throttle of 600 pounds per square inch gage, 750 deg. F. total temperature, and exhaust at 2 pounds per square inch gage. The generator delivers power at 6300/10,900 volts, 50 cycles, 0.8 p.f., 3,000 r.p.m., and 6,250 kva.; it is equipped with air filters to aid in maintaining cleanliness of the machine.

Auxiliary Equipment

Power for the train auxiliaries is furnished by the 750-kva. air-cooled transformer at 380/220 volt, 3 phase, 50 cycle, 4 wire. The transformer is connected to the 5,000-kw. generator through fuses and is provided with low voltage breaker assembly for motor and lighting service. The breaker assembly is mounted within the transformer housing.

For use in starting up the power train, a 93.8-kva., 75-kw., 380/220-volt, 4-wire, 50-cycle diesel engine-driven generator set is provided.

Car No. 4 carries the following auxiliaries: two 3,600-r.p.m. boiler feed water pumps each capable of supplying 208 gallons per mintue; one evaporator unit to provide makeup of 2,400 pounds per hour of 32 F. water with deaerator; water-treating equipment; three 400-c.f.m. air compressors to supply air to operate stokers, spreaders and soot blowers. The thermally insulated feedwater car has 10,000 gallons capacity.

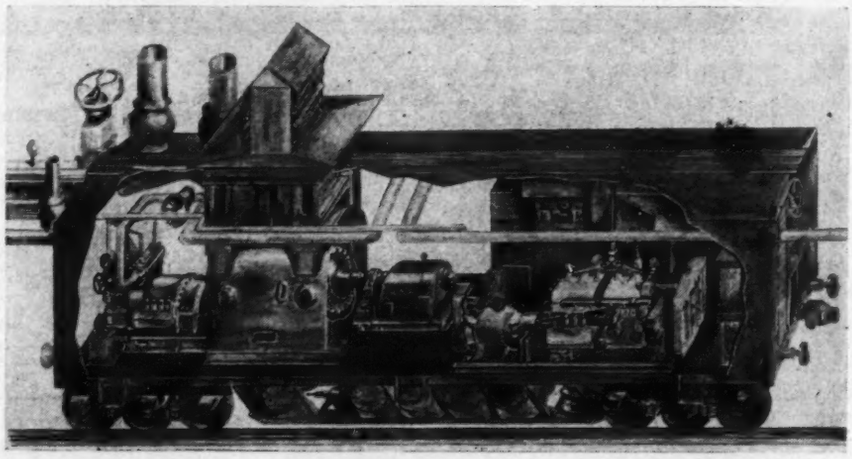
All the above information is obtained from a paper by C. M. Laffoon (Westinghouse) at a recent meeting of the A.S.M.E. in Pittsburgh. Ensuing details regarding the boilers have been supplied by A. R. Smith, Combustion Engineering Co.

Boiler Design

Two boilers are provided per train, each capable of generating 40,000 lb. of steam per hour at 625 psi. and 750 deg. F. total steam temperature at the superheater outlet. The design pressure is 660 psi., and they have been designed to burn low-grade bituminous coal of about 7,300 B.t.u. per lb. having an ash softening point of 1,800 F.

Fuel burning equipment comprises a Standard locomotive-type spreader stoker, a Hudson-type locomotive grate, a fully water-cooled furnace, and a locomotive-type combustion arch. The boiler is of the bent-tube type of novel design, having a four-steam pass drainable superheater, and a marine-type extended surface economizer. Serving this combination are both forced- and induced-draft fans of conventional design, a water level regulator, and the necessary instruments of the indicating type.

The boilers are small, from the standpoint of weight and physical dimensions, compared with conventional stationary practice for an equivalent steaming capacity; and are the largest so far constructed for burning solid fuels in mobile railway operation. The steam demand of each is



MAIN turbine generator unit, switchboard and diesel-engine driven auxiliary

roughly that of a Liberty ship at full speed. The permissible weight limit of 114,000 pounds is met by unloading to other cars those items which are readily removed such as grates and arch tile and also those pieces of equipment which are normally removed in transit, such as ash pans, soot-blower heads and stacks. Maximum furnace length is governed by the ability of the spreader stoker to throw the coal when operating on compressed air maximum permissible grate size is 107 square feet and combustion rate at design capacity if 90 pounds per square foot per hour.

Air Operations

To avoid waste of water, air operation was chosen for stoker engine, stoker jets and soot-blowing. Total requirements exceeded the compressor capacity that could be installed within the available space. But inasmuch as the free air requirement diminishes with increasing temperature, the maximum compressor capacity was supplemented by an air preheater using waste heat. This preheater handles all of the air going to stoker-drive engine and jets and is located in the duct immediately below the economizer. A temperature of 450 F. was judged adequate. No only did the preheater save on equipment, but it also saved weight and compressor power.

The use of preheated air in a reciprocating engine designed for steam posed a problem in lubrication. Since a prediction of results which might be expected was hazardous, it was deemed wise during design stages to make a full scale setup to test not only this point but also the effect of substituting air for steam at the distributor plate and to determine the quantity of air required to operate both engine and jets. As far as is known, stokers of this type had never before been operated on air. A suitable oil which would neither carbonize nor gum the valves was found.

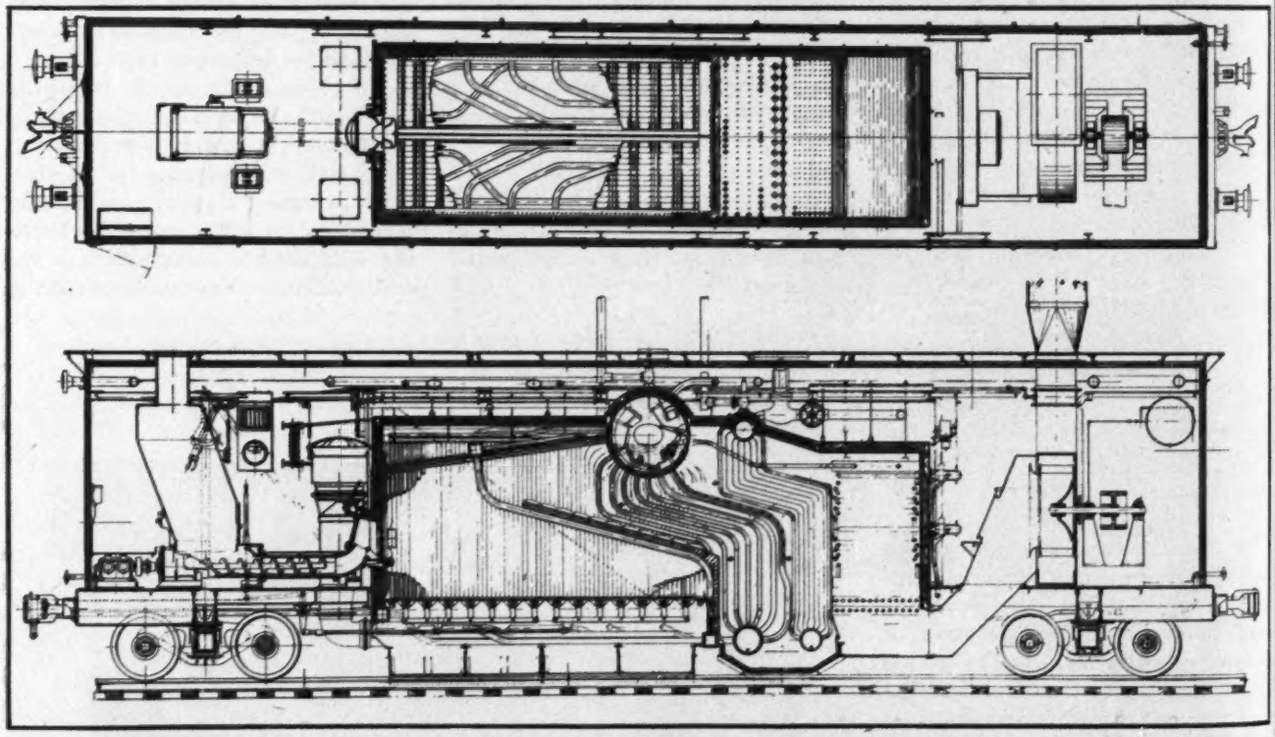
The 1,000-kw. power train unit consists of one boiler car, one turbine generator car, one cooling tower car, and coal handling equipment. Each car is mounted on two four-wheel trucks. The boiler car contains a 16,000 pound per hour, two-drum water-tube boiler designed for 420 pounds per square inch gage and 730 F. The boiler is being designed, built, and assembled as a package unit on the car by the Babcock & Wilcox Co. This car also includes a locomotive type over-feed coal stoker, a steam-operated stoker-feed engine, 50 hp. motor-driven induced draft fan, water treating equipment, auxiliary steam driven boiler feed pump, coal hopper and water storage tank.

The turbine-generator car contains a 1,000 kw., 0.8 p.f., 350 kva., 3 phase, 50 cycle, 1,000 r.p.m., 6,300 volt Westinghouse generator which is driven through a reducing gear by a Westinghouse steam turbine which is designed for using steam at 400 pounds per square inch gage, 725 deg. F. temperature and exhaust pressures of 2 in. to 5 in. Hg absolute pressure.

Cooling Tower Car

A two-cell induced-draft type cooling tower is carried in a special car designed and built by American Car & Foundry Co. Each cell contains two motor-driven vertical fans and between the cells is located a common vertical motor-driven condenser circulating water pump.

The cells and super-structure of the car are of California redwood. The cooling towers were designed and prefabricated by the Foster-Wheeler Corp. They are designed so that when reaching the point of ocean shipment, each cooling tower section can be removed from the car as a unit and shipped on the lower decks of the ships.



THERE ARE two boilers like the above for each 5,000 kw. power train. Each boiler is capable of producing 40,000 lb. of steam per hour at 625 psi. and 750 deg.F. total temperature at the superheater outlet. They are designed to burn low grade bituminous coal of about 7,800 B.t.u. per lb. having an ash softening point of 1,800 deg.F.

Simplicity, Reliability, Economy Designed Into Pit 5 Plant

Basic design of 160,000-kva. P. G. & E. hydro plant incorporates simplicity, reliability and ease of operation to be competitive with low first cost steam—Removable barrel bottom permits runner removal with increased ease and minimum dismantling

E. F. MARYATT, Pacific Gas & Electric Co., San Francisco, Calif.*

SIMPLICITY and reliability were the objectives in planning Pit 5, the largest hydroelectric plant now built by the Pacific Gas & Electric Co. If a hydroelectric station is to be successful against its one competitor, steam, it must be simple and reliable and it must also be convenient to operate and easy to maintain. A modern steam plant has none of these features to a marked degree, but it does have the very special advantage of requiring less than half the cost per kilowatt to build. The only way that a hydro plant can compete under this handicap is by having the advantage of low operating costs and by the ability to operate without interruption over long periods of time. Simplicity and convenience of operation, reliability and ease of maintenance are the attributes by which these things are realized and were prime considerations in designing Pit 5.

This most important addition to the P. G. & E. system which was formally placed in operation April 29, 1944, increase the generating capacity by 160,000 kva. There are installed four vertical Francis water wheels of 50,000 hp. each operating under 587-ft. effective head, 630 ft. static, 300 rpm., each driving a 40,000-kva., 0.8 power factor, 11,500-volt generator. The four water wheels were designed and built by the Pelton Water Wheel Co. of San Francisco, and the generators were by the Westinghouse Electric & Mfg. Co. and the General Electric Co., two each. The four generators feed into two banks

FOUR 40,000-kva. generators are driven by 50,000-hp. Francis type turbines operating under a head of 587 ft. Plant constitutes two stations in one

of transformers of 81,000 kva. each stepping up the voltage from 11,500 volts to 230,000 volts for transmission over two outgoing lines. There are four five-cycle, 230-kv. pneumatically operated G.E. oil circuit breakers. Two oil circuit breakers for each transformer bank make it possible to switch either or both transformers to either line, or vice versa. The transformers are single-phase Westinghouse self-cooled.

Layout of the Station

Final layout of this station represents the best of ideas contributed by many persons interested in developing a simple, convenient and accessible arrangement of floors and equipment, resulting in a power plant which can be operated by not more than three men on a shift. The switchboard room is located centrally with respect to the four units and on the generator floor level. The distance from the most remote generator to the operator's desk is only 75 ft. One floor up from the switchboard room are the 11,500-volt metal clad oil circuit breakers and cubicles; also the station power transformers and bus equipment. One floor down from the switchboard room is the turbine floor on which are located the butterfly valve controls, relief valve controls, the oil-treating equipment and the air-treating equipment. A basement below this affords accessibility to the lower side of the turbine for removal of the runners, the removal of relief valve discharge parts, and spacious location for the two groups of cooling water pumps, sumps and unwatering equipment.

Developing 630-Ft. Head

Ten miles of Pit River rapids around the Big Bend in the river where the water falls from an elevation of 2,060 ft. at the intake to El. 1,426 at the powerhouse, provides the natural power site for this project. Water is diverted with a concrete diversion dam into the intake of tunnel No. 1, 5,148 ft. long, 19-ft. diameter. An open conduit section 3,124 ft. long connects this tunnel with a second 19-ft. tunnel which continues 23,141 ft., ending in a manifold dividing the water between four all-welded steel penstocks 1,380 ft. in length, 108-in. diameter upper end and 90-in. diameter lower end. These penstocks drop down the mountain side and deliver

* Assistant Hydroelectric Engineer

the water to the four units which relieve it of 90 percent of its energy and redischarge into the river.

To assist in accelerating and decelerating this column of water 21,141 ft. long an 88-ft. diameter differential surge chamber is constructed in the side of the mountain and is connected to the tunnel above the entrance to the penstocks.

Runner Removal Made Simple

At Pit 5 the bottom of the barrel is removable. At the basement floor level a tunnel is formed through the unit foundation exposing the upper end of the steel draft tube. This exposed portion is removable which permits lowering the bottom ring cover from the turbine. It is then a simple matter to unbolt the runner from the bottom of the shaft and lower it down in position for removal horizontally through the tunnel provided.

To make the powerhouse crane available for handling the runner the main shaft of the unit is provided with a hole bored through its entire length. A steel cable is lowered through the shaft from the crane and is attached to the runner with suitable fittings. This scheme has greatly reduced maintenance and has eliminated many days of unit outage for this company. The idea was first suggested many years ago by P. G. & E. engineers and was developed by the turbine builder. It is now a standard feature with this company.

Air Treating and Ventilation

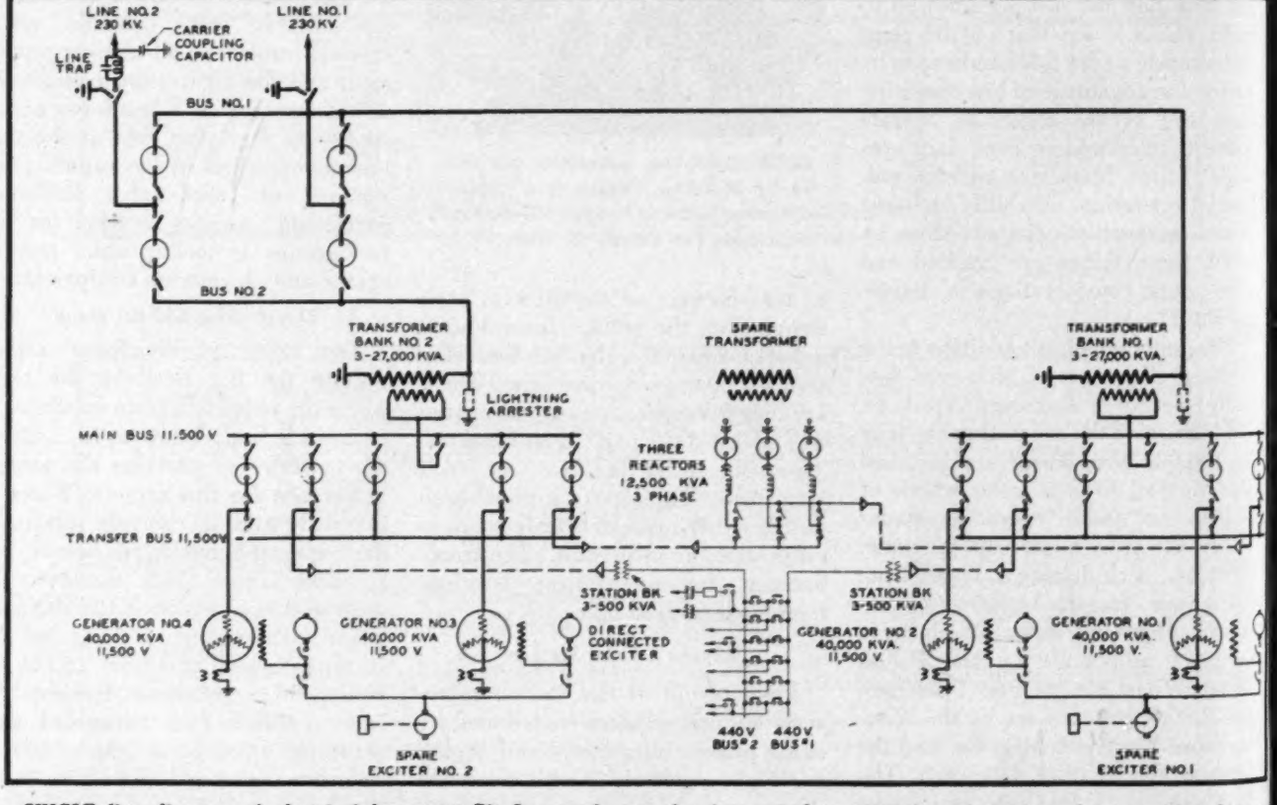
To reduce the amount of sweeping and cleaning to a minimum all air entering the station is filtered by a central blower system. A positive pressure of air inside the station is maintained at all times to prevent dust from sifting in from outdoors. Main air supply to the station may be kept at a comfortable temperature through a heat exchanger using warm water from the generators for heating and cool water from the tailrace for cooling.

An additional heating and cooling unit automatically maintains uniform temperature in the switchboard room. Fluorescent lighting units were used in the switchboard room because of the lesser amount of heat from these units, reducing the refrigeration capacity needed for cooling. The louvre-equipped lighting units were evenly distributed and provide ideal switchboard room lighting giving 60 foot-candles at the benchboard level with a total absence of glare on the instruments. There is no diffusing glass platform to accumulate dirt and shut off the light.

Units Grouped in Pairs

To further simplify the operation of this plant the four generators are grouped electrically into pairs. By such grouping, the plant takes on the aspect of a two-unit plant. This is made possible by isolating from each other the two groups of 11,500-volt bus into which the two pairs of generators feed. One transformer bank for each section of 11.5-kv. bus feeding into one of two high-voltage lines completes the segregation. The two 11,500-volt bus rooms are isolated physically by the station service room between and electrically by there being no possibility of paralleling the two groups. Paralleling of the two 80,000-kva. generator groups is done only at 230 kv.

Other benefits from this segregation are: Increased transmission stability by the division of the station output between two loaded transmission lines leaving them unparalleled at the sending end, minimizing the proportion of station generator outage from line trouble; provides 80,000 kva. to facilitate transmission line



SINGLE line diagram of electrical layout at Pit 5 powerhouse showing complete two-unit segregation of generators, buses and switching carried clear through to the two transmission lines

charging; eliminates the necessity of an 11,500-volt oil circuit breaker in the low-voltage side of the main transformers which would have to be in excess of 4,000-amp. capacity.

Transmission Charging Problem

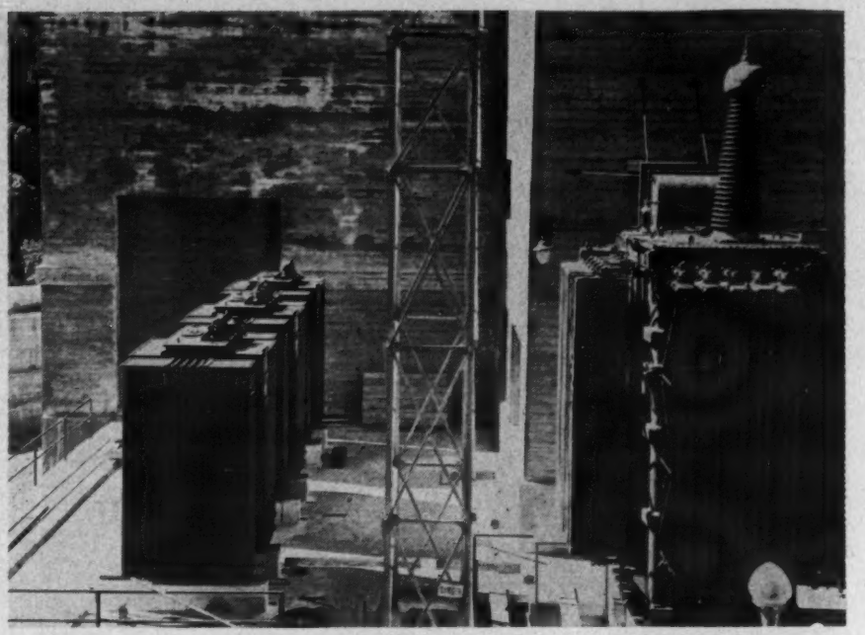
Interconnection of the 230-kv. transmission system was necessary to permit the transfer of power from Shasta Dam, shortly to be available, to areas where it can be utilized. This interconnection created the occasional necessity of charging approximately 300 miles of 230-kv. transmission line. Because of war conditions synchronous condensers for the receiving end of the line were not obtainable.

Estimates indicated the charging current requirements to be slightly in excess of that to be expected from one of the 80,000-kva., two-generator units with zero field excitation. An attempt to charge the line under these conditions would result in self-excitation of the generators and produce an uncontrollable rise in voltage.

To permit a reasonable amount of field excitation and to reduce the amount of line charging current required of the machines, it was determined that 37,500 kva. of shunt inductive reactance would be required. This reactance was purchased in three units, each consisting of one three-phase G. E. Co. 12,500-kva., 11,500-volt outdoor reactor. Installed facilities permit the switching of one, two or three of these reactors on to either 11,500-volt bus section. The flexibility of this arrangement increases the use to be derived from these reactors in addition to that for line charging.

No Pilot Exciters

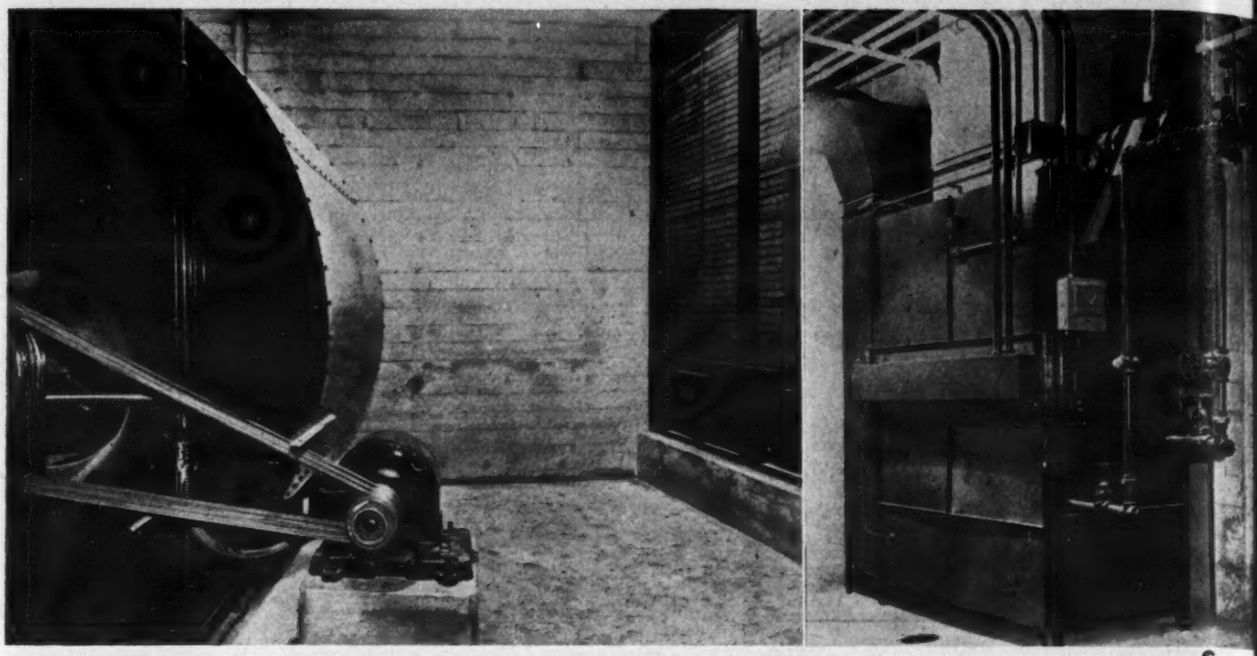
Generators are equipped with direct connected exciters. A pilot exciter, if used to furnish the field current of the main exciter would be driven from the main shaft with speed identical to that of the generator. Rejection of full load on one of the generators will be followed by speed rise of approximately 25 percent. A pilot exciter does the wrong thing at the wrong time. The overspeed causes the pilot exciter voltage to rise at just the time it is desirable to have it fall. This increases the difficulty of holding the generator voltage (which climbs rapidly with increased speed) within reasonable limits. Such performances are especially undesirable on a 230-kv. system.



37,500 KVA. in three reactor units was installed at Pit 5 to permit sufficient field excitation to charge 300 miles of 230-kv. transmission line

To provide the stable voltage source desirable for the main exciter field, it was suggested by J. P. Jollyman, chief of the Division of Hydroelectric and Transmission Engineering of this company, several years ago, that the station d.c. control battery be used to furnish the main exciter field current, it being the most stable and reliable source of voltage in any station. This suggestion was made in 1938 and was immediately worked out for Phoenix powerhouse which was then being planned. It is now in successful operation in four hydroelectric stations. Pit 5 becomes the fifth, but is the first on the 230-kv. system. As to equipment involved it simply amounts to increasing the capacity of the battery charging sets a sufficient amount to supply the 15 or 20 amp. required per generator. Should the charging set

PIT 5 powerhouse located on Pit River near Redding, Calif., becomes P. G. & E.'s 52nd hydro plant, developing 160,000 kva., and bringing total hydro capacity to 1,082,191 kva. The four penstocks are 1,380 ft. in length



PLANT maintenance is reduced and comfortable temperature is maintained by self-cleaning air filter and air conditioning system. Cleaner, mounted in wall, and blower at left; heating and refrigeration unit (right)

trip off at any time, the control battery will supply the excitation temporarily until normal charging is resumed.

Station power is supplied from either one or two auxiliary power transformer banks 11,500 to 440 volts, 1,500-kw. capacity, each sufficient to supply the entire station requirements. One bank is fed from each section of 11,500-volt bus. Normally the station power load is divided between the two sources of supply, each section of the station taking care of its own auxiliary power requirements.

To prevent paralleling the two sections of the station through the station auxiliary transformers, a double 440-volt bus, metal clad cubicle type construction, was installed. By means of two remotely operated circuit breakers in these cubicles, mechanically and electrically interlocked with each other to the effect nearly instantaneous double throw, each 440-volt power feeder in the station may be cut over from one bus to the other. To simplify the cut over, the closing button for th open breaker trips the closed breake and closes the open breaker consecu tively. Thus it is simple to cut ove the 440-volt auxiliary feeders to on source of supply if occasion require No spare transformers for these bank is needed since one bank becomes th spare for the other.

ONCE in a hundred years there may come the flood of 75,000 cfs or more for which the roller gates of the intake are designed

Relays and Protection

Relay protection is relatively sim ple, yet complete. The 230-kv. line have directional over current, direc tional residual and over voltage fo any combination of line switching The main transformers, 11,500-vol bus and the generators have differ ential relay protection overlappin the sections. The generators, in addi tion to differential protection, hav over current, over speed, and elevate neutral protection.

This elevated neutral protection i obtained by connecting the high volt age winding of a 15-kw., 7,200-vol distribution transformer in series be tween the generator neutral and ground and loading the low voltag winding to capacity with grid resistor and connected to register an alarm only.

In addition to duplicate metallic telephone circuits, two-frequency du plex carrier telephone equipment is being supplied by the General Elec tric Co. on the interrelated 230-kv. circuits.

The Watthour-Meter—Modern vs. Old

Extended tests conducted by eight utilities to determine the comparative registration of recent and older types of meters on a typical spread of residential usages—Correlation also established between maximum kw. demand and monthly kwh. usage

*ARTHUR B. CRAIG, Transmission and Distribution Department, Boston Edison Co.**

In late 1940, a survey on a national scale was started to determine the comparison of registration of modern and older types of meters. Two methods were proposed: the first involved the installation of a modern meter in series with the existing meter for the obtainment of comparative data; the second involved the installation of recording meters to obtain all pertinent facts on load characteristics. Of the two methods, the Modern-Meter-Comparison method appeared to be more practical for the purposes of this investigation and was therefore adopted.

A suggested procedure and data sheets were prepared and sent to a number of electric utilities. Briefly the suggested procedure called for the series installation of a modern 15-amp. meter with an existing 5-amp. meter of the type manufactured between 1914 and 1926 whose normal monthly usage exceeded 75 kilowatt hours, both meters to be read monthly for a period of six months. Modern and older type meters were all to be calibrated at the beginning of the test so as to be within an accuracy range of 99.8 percent and 100.0 percent at both full and light load calibration points. The installation of 15-minute demand meters was also recommended. The investigation was limited to the 5-amp. size of older type meters and to domestic loads with the understanding that future investigations might be made on larger meters and on commercial loads. Individual monthly readings which did not cover a 28-32 day period were prorated on a 30-day basis, and cases showing a usage of less than 10 kilowatt hours were excluded.

Before this investigation reached the actual field test stage, December 7, 1941, arrived! Thereafter, for obvious reasons, many companies found it impossible to make any tests and

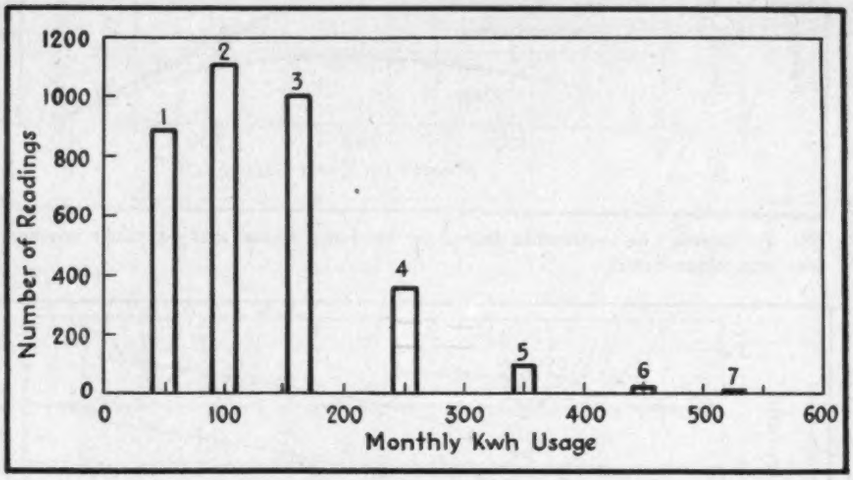


FIG. 1—Number of readings in various monthly kilowatt hour usage ranges kwh. per month: (1) 10-75; (2) 86-125; (3) 126-200; (4) 201-300; (5) 301-400; (6) 401-500; (7) over 500

* Head of Meter Section.

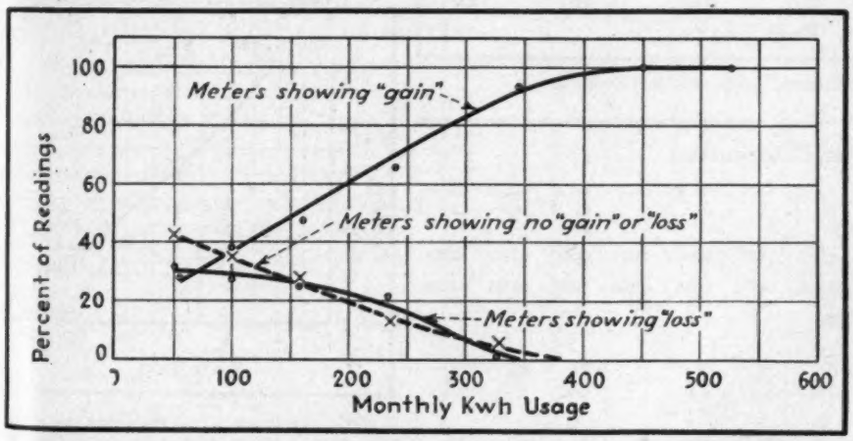


FIG. 2—Percent of readings which show "gain," "loss" and no "gain" or "loss." "Gain" is excess registration of modern meter over older type meter. "Loss" is excess registration of older type meter over modern meter

others had to limit the number of installations. However, eight companies did participate; six of them obtained comparative readings for a period of six months, the other two extended their investigation over a twelve-

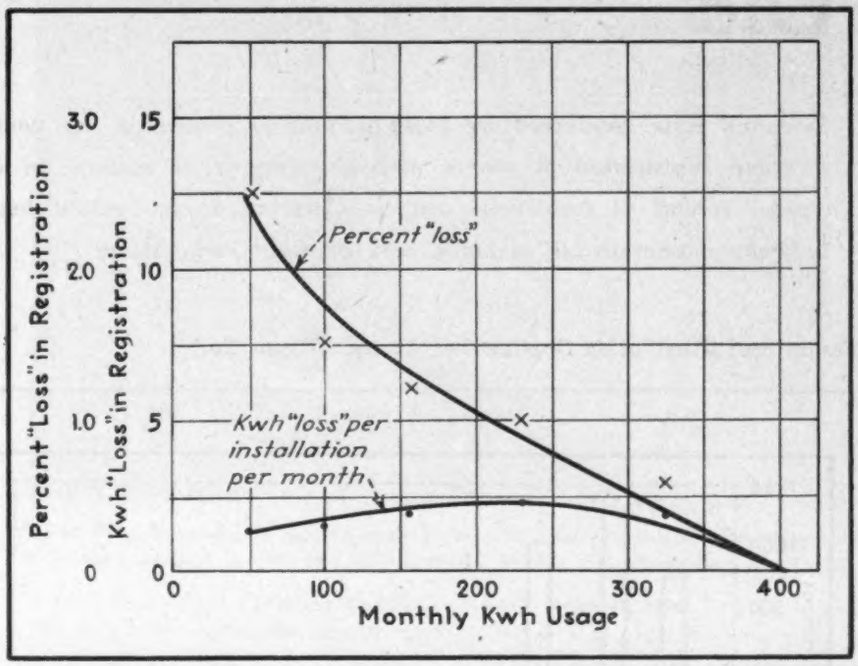


FIG. 3—"Losses" in registration shown by readings where modern meter registered less than older meter

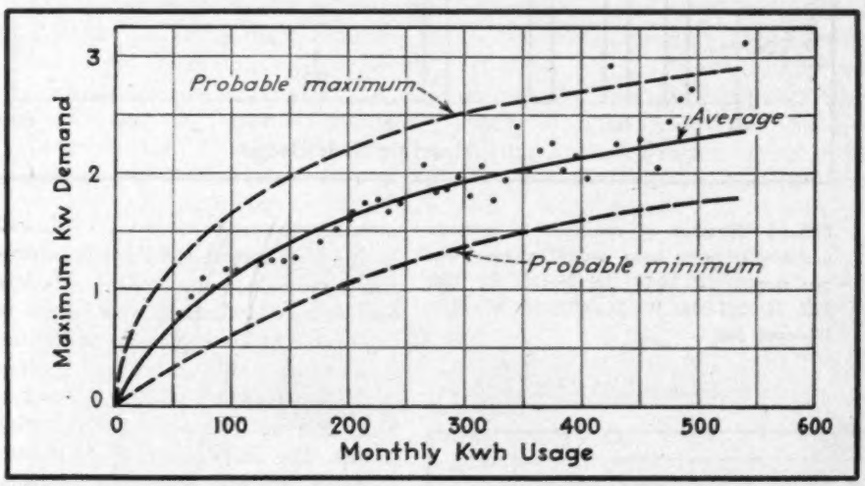


FIG. 4—Relation between maximum kw. demand and monthly kwh. usage

Watthour Meter Comparison

	Total	Co. 1	Co. 2	Co. 3	Co. 4	Co. 5	Co. 6	Co. 7	Co. 8
Number of Installations	442	53	50	56	50	48	11	102	72
Duration of Test (Months)	8.1	12	6	6	6	6	6	12	6
Total Registration of Modern Meter (khw.)	439469	69630	45079	55278	60843	42849	7953	92480	65357
Total Registration of Older-Type Meter (kwh.)	437120	69497	44820	54872	60439	42496	7887	92123	64986
Modern Meter Gain (kwh.)	2349	133	259	406	404	353	66	357	371
Modern Meter Gain in percent	0.5	0.2	0.6	0.7	0.7	0.8	0.8	0.4	0.6
Gains in Registration:									
(a) Number of Installations	253	24	35	30	18	37	8	59	42
(b) Total kwh. gain	3450	344	346	500	565	384	90	553	638
Gain/Installation/Month (kwh.)	1.6	1.2	1.6	2.8	5.2	1.7	1.9	0.8	2.5
Losses in Registration:									
(a) Number of Installations	161	25	10	19	29	10	3	36	29
(b) Total kwh. Loss	1111	211	87	94	161	31	34	226	267
Loss/Installation/Month (kwh.)	0.8	0.7	1.4	0.8	0.9	0.5	1.9	0.5	1.5
Installations showing no gain or loss	28	4	5	7	3	1	0	7	1

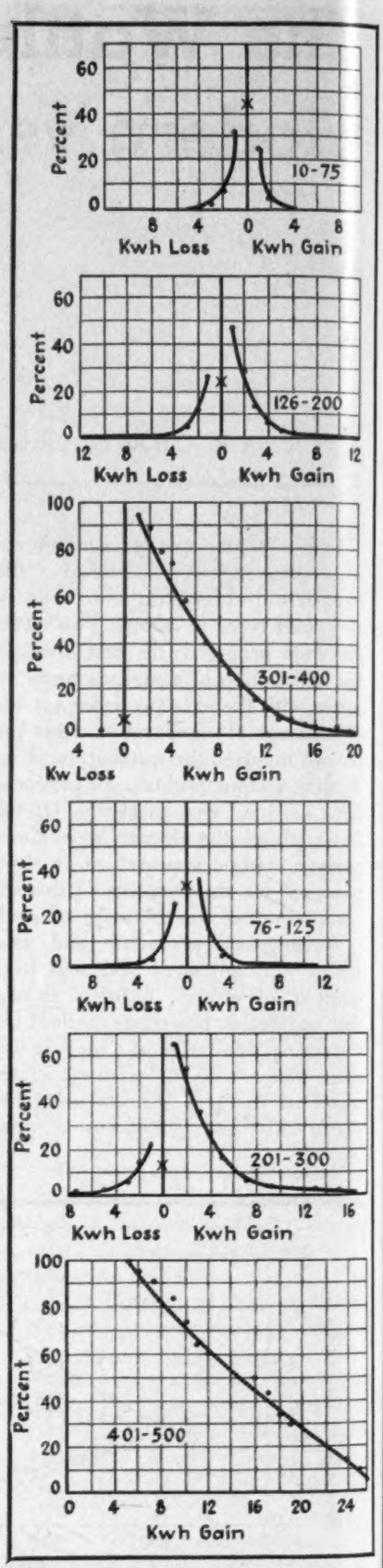


FIG. 5—Percent of readings in each range group showing monthly kwh. differences at least as great as indicated by the abscissae. Figures on each indicate monthly kwh. usage.

month period. There were a total of 442 installations with 3,580 comparative monthly readings. Particularly noteworthy is the fact that approximately 25 percent of the installations and 35 percent of the readings came from the Pacific Coast.

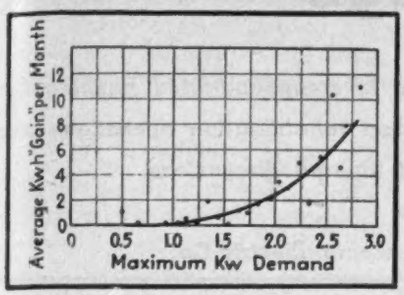


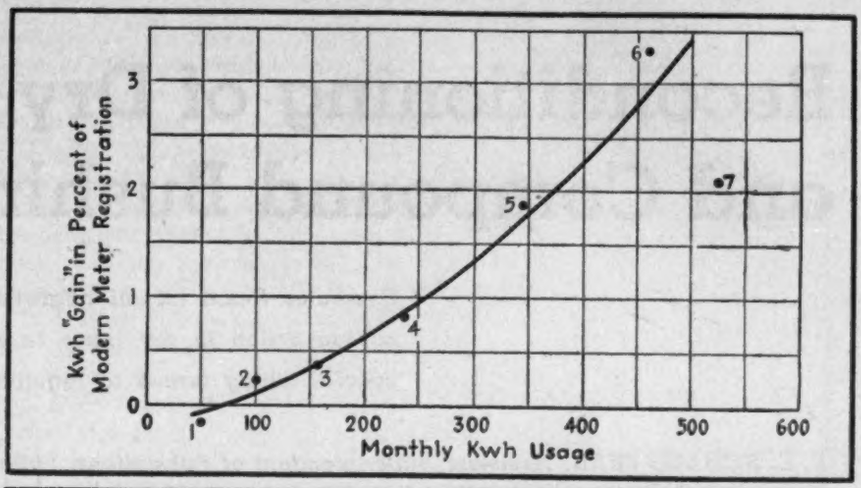
FIG. 6—Relation between maximum kw. demand and average kwh. "gain"

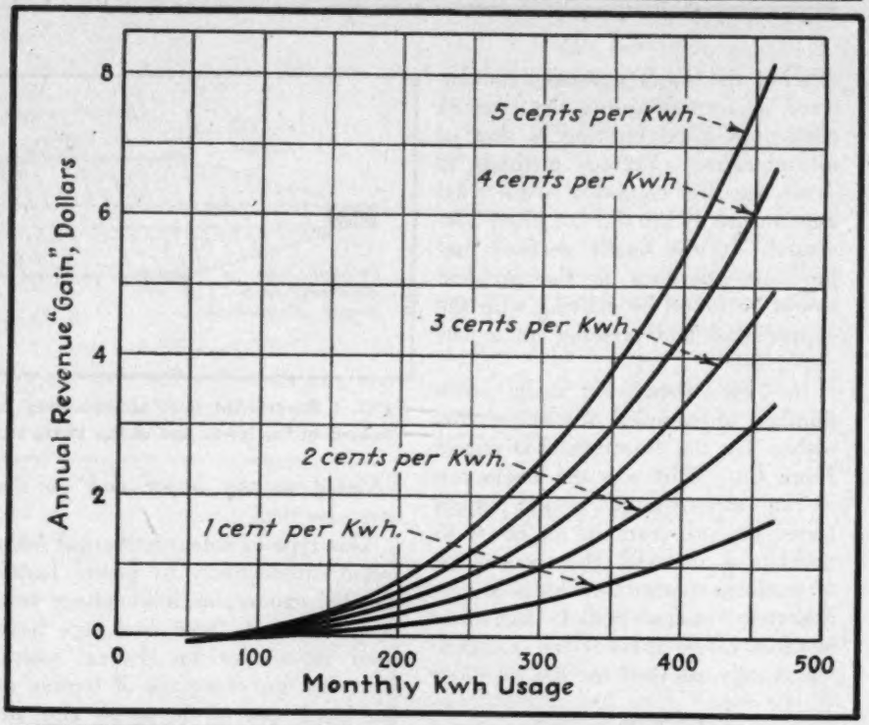
One company reported that in a survey of two meter reading routes having a total of 517 customers, the customers with 115-volt, 2-wire meters and with a usage in excess of 75 kilowatt hours were distributed as follows:

Size of Meter	Customers Using 75-125 kwh.	Customers Using 125-200 kwh.	Customers Using over 200 kwh.
5-1-2	61	39	10
10-1-2	37	17	10
15-1-2	11	6	0
	109	62	20

The 442 installations investigated naturally are only a very small fraction of the total number of older type 5-amp. meters in domestic service, but they are representative of this type of installation and these results should give a reasonable indication of the conditions that may be expected in service.

It is believed that the table and curves are self-explanatory and are therefore offered without comment. Individual situations should be carefully analyzed before attempting to apply these data.





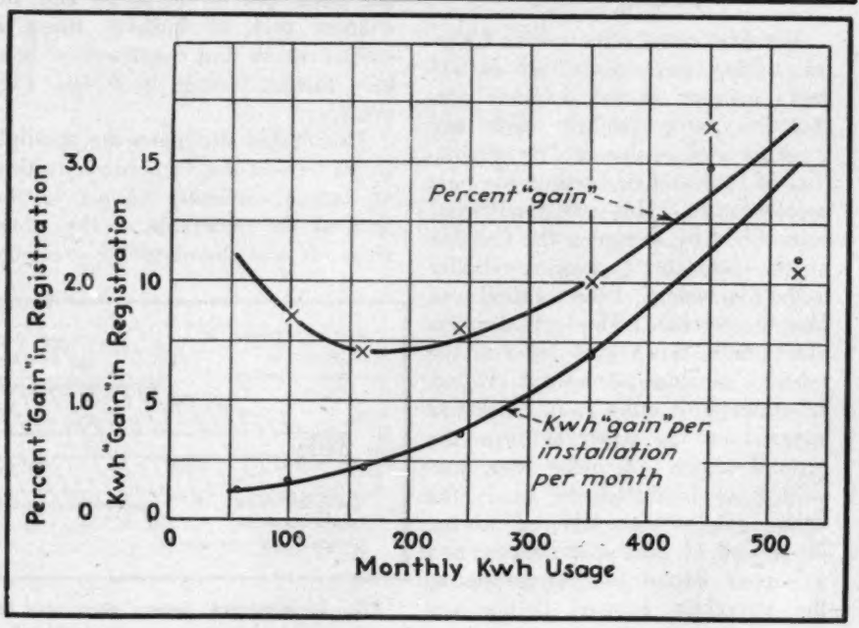


FIG. 7—Average kwh. "gain" for various monthly kwh. usages. Points represent same brackets of consumption as in Fig. 1

FIG. 8.—Approximate annual revenue "gain" from modern meter for various monthly kwh. usages

FIG. 9—"Gains" in registration shown by readings where modern meter registered more than older meter

Reconditioning of Dry and Compound Bushings

Remedies found for oil migration in compound-filled bushings and corona action in dry types in shop rehabilitation operations using special tubing turned to required tapered dimensions

E. L. SCHLOTTERE, Assistant Superintendent of Substations, Philadelphia Electric Co.

ONE of the major problems encountered in reconditioning the type SI compound filled bushing is that of oil migration. Various methods to overcome this condition were tried experimentally but did not prove successful. It was finally decided that the best approach to the problem would be found by starting with the copper stud and pressing on a new paper tube.

In 1938, tests were made on a number of samples of tubing furnished by the Continental-Diamond Fibre Co. This was the beginning of an experimental period which lasted several years in an effort to develop a material that would be of uniform quality and have proper dielectric characteristics including low loss values at 60 cycles. Cellulak was finally adopted for the purpose.

Developing Design

The first cores rebuilt with Cellulak tubing were assembled in the same manner as the original construction using cambric cloth and a copper ground sleeve. The elimination of the cambric became the next consideration. This was readily accomplished by wrapping the Cellulak on the conductor to form a cylinder to the dimensions of the original core plus the cambric. This cylinder was then turned down in a lathe to the tapered dimensions desired, Figure 1. A copper coating $\frac{1}{32}$ in. thick was sprayed on the paper to form the ground sleeve. A brass ring, machined as indicated, to grade the voltage stress was soldered to the lower end of the spray coating and a copper flange for connection to the porcelain support flange was soldered to the upper end of the spray coating.

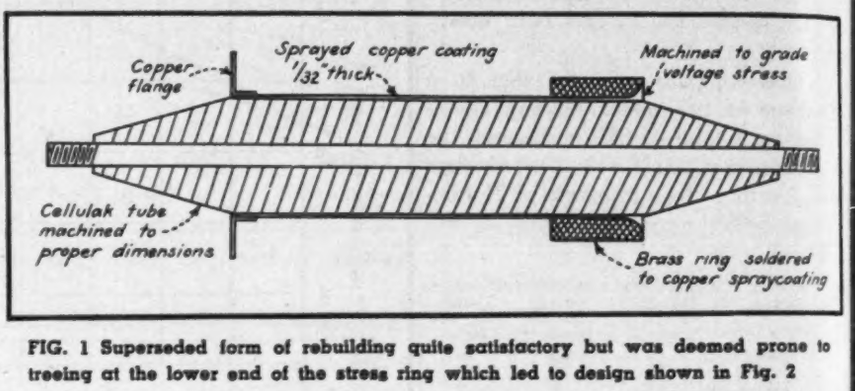

Copper flange
Sprayed copper coating 1/32" thick
Machined to grade voltage stress
Cellulak tube machined to proper dimensions
Brass ring soldered to copper spraycoating

FIG. 1 Superseded form of rebuilding quite satisfactory but was deemed prone to treeing at the lower end of the stress ring which led to design shown in Fig. 2

This type of construction has been tested satisfactorily by power factor and the one-minute hold-voltage test. A number of these bushings have been in service for several years. However, the discovery of treeing at the lower end of the stress ring on another type of bushing using a similar stress ring construction, lead to a further change in design, Figure 2.

This design eliminates the possibility of treeing due to a concentration of carbon, moisture or air in the area at the underside of the stress ring. It also increases the creepage path at the lower end of the bushing and provides a greater thickness of paper insulation between conductor and ground. Power factor and one-minute hold-voltage tests on this type of bushing have been satisfactory. Figure 3 shows an impulse breakdown curve on a 34.5 kv. circuit breaker bushing of this design. The breakdown occurred under an applied steep wave of 520 kv. at 0.3 microseconds. The sketch indicates the puncture of the paper core on the lower end and passing back partly through the laminated structure of the paper to the copper ground shield. Previous to breakdown, the bushing had passed the following tests:

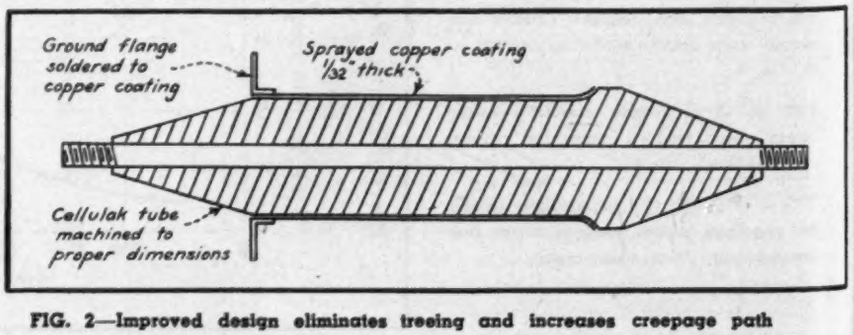

Ground flange soldered to copper coating
Sprayed copper coating 1/32" thick
Cellulak tube machined to proper dimensions

FIG. 2—Improved design eliminates treeing and increases creepage path

One-minute hold-voltage = 115 kv.
Power factor (in air at 26° C.) = 2%
Power factor (in oil at 26° C.) = 1.6% m.m.f. = 121
R.M.S. 60 cycle flashover = 154 kv. (Avg.)

The cost of reconditioning a bushing with this type of core is approximately 30 percent to 40 percent less (depending on ampere rating) than the use of a manufacture replacement core.

Dry Type

The simple dry type bushing (15 kv. to 34.5 kv.) consisting of a single piece porcelain and a cambric wrapped conductor has reached power factor values up to 45 percent. In most cases this was caused by corona action on the cambric and the presence of moisture since this type of bushing is not oil or weather tight. The litharge and glycerine cement used to hold the mounting flange to the porcelain is also a source of constant maintenance because of its porosity.

When reconditioning this bushing the litharge and glycerine is replaced with Portland cement. The cambric is removed and the conductor is thoroughly cleaned. As shown in Figure 4, one copper spinning is sweated to the terminal cap and another to the top washer. The bottom plate is located on the stud and sweated in place.

The bushing is assembled as follows:

1. Place the stud, with a glyptol treated cork gasket on the lower plate, into the porcelain. Hold in place with a jig.
2. Preheat this assembly and fill the porcelain with Mineralac-33 compound.
3. Place a Glyptol treated cork gasket and the top washer on the porcelain.
4. Insert a bronze cup spring washer as shown.
5. Screw the terminal cap on the stud (against the spring washer) until the desired gasket compression is obtained.
6. Turn the lower edge of the top spinning over the lower spinning and sweat together to make a water-proof joint.
7. Sweat the top washer to the stud.
8. Test assembly at 15 lb. sq. in. air pressure. (use ⅛ inch pipe plug hole in terminal cap)

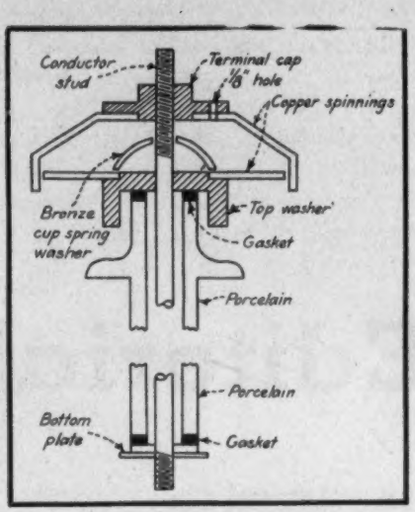


FIG. 4 Dry type bushing improved by removing cambric and replacing the porous litharge and glycerine cement with Portland cement

9. If test is satisfactory, install plug.

The assembled bushing is then tested by power factor and a one minute hold voltage test applied. A number of these bushings have been in service for several years and the power factor has remained stabilized at low values. Air pressure tests may be made in the field at time of power factor test if it is considered desirable to do so.

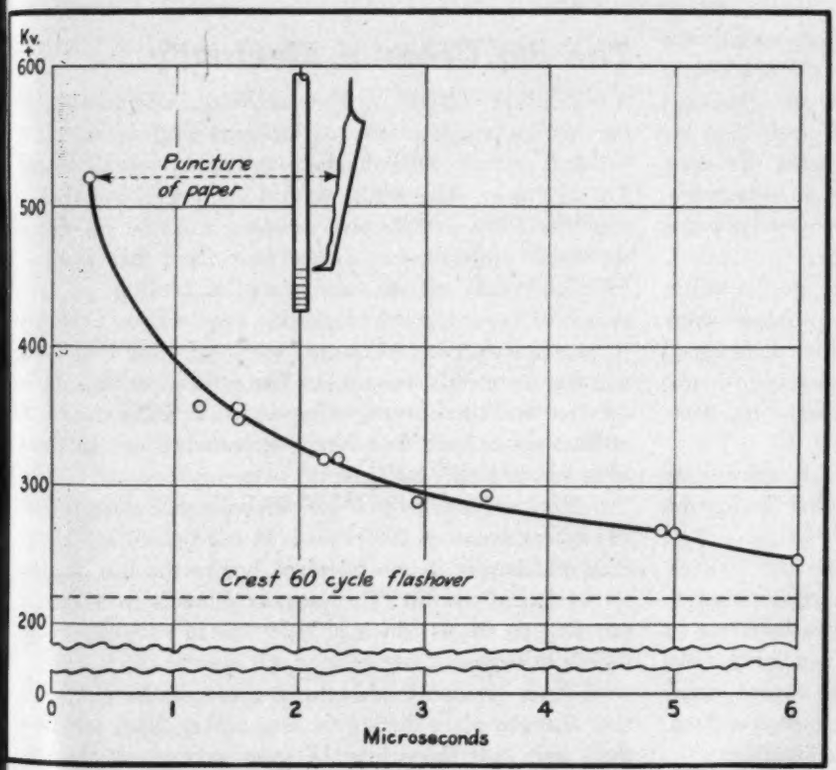


FIG. 3 Impulse breakdown of 34.5 kv. rebuilt type SI-OCB bushing occurred in 0.3 microsecond at 520 kv. relative air density = (17.9 x 29.36/522 = 1.00678; no humidity correction established

Hydrogen Pressure

In the report of the A.I.E.E. session at St. Louis on power generation (page 80 of July 8, 1944 issue of ELECTRICAL WORLD) it was inadvertently stated that the maximum capabilities cited were based on 15 psi. hydrogen cooling. Chairman M. S. Oldacre has called our attention to the fact that the six newly proposed maximum capabilities for standard generators (12,500 to 66,000 kva. contemplate the use of air cooling for the two smaller units and hydrogen cooling at 0.5 psi for the four larger units.

These ratings and the corresponding values of power factor, short circuit ratio and the added capabilities obtained by raising the hydrogen pressure will be discussed in a forthcoming article by Chairman Oldacre in ELECTRICAL WORLD. That article is designed to explain what the joint A.I.E.E. - A.S.M.E. committeee has evolved for a new line of standardized turbogenerators with appropriate characteristics and margins.

Editorials

S. B. WILLIAMS, *Editor*

How Reconversion Policy Might Be Interpreted

IN BRINGING the reconversion battle between WPB and the military to a head it isn't quite clear whether WPB Chairman Nelson has won or lost the order while winning the argument. It does, however, offer opportunity for speculation as to its effect upon electric utilities and their suppliers.

In the ordinary meaning of reconversion, neither the utilities nor their suppliers for the most part have a reconversion problem. In very few instances will retooling be a deterrent to the immediate resumption of production for civilian consumption. The utilities will serve the same factories making something else and the manufacturers will in most instances make the same equipment for peace as for war.

But reconversion isn't as simple as that for the utility industry. It has a special kind of reconversion which might be called restoration of service quality. It is hoped that the Office of War Utilities is giving some consideration to this in its interpretation of permissible reconversion.

For power-producing equipment such an extra long cycle of manufacturing time is required that during the balance of this year the industry and OWU will have to be thinking not about needs for 1945 but for 1946. Therefore, WPB ought to give very special consideration to some sort of a program that will permit scheduling of power plant equipment orders now. If something like this isn't done the manufacturers will be forced either to let workers with special skills go or, just to protect themselves, keep these men on the payroll boondoggling.

In the field of transmission and distribution, where less time is required for manufacture, another reason exists for at least moderate relaxation by OWU. While utility systems have gotten by so far with a splendid record of minimum interruptions, there has been a constant and growing risk to service because of decreasing reserves. This hazard should not be countenanced one day longer than is absolutely necessary.

We are not urging relaxation at the expense of the war effort, either where material is hard to get or where labor is tight. In these situations the lid should stay on, but otherwise we feel that selective relaxation in moderate amounts at this time will be very helpful. There is every indication that most manufacturers supplying this field can handle utility orders without interfering with war orders. Where they are making urgently needed war equipment, such as radio and radar parts, it would be reasonable to expect relaxation only to the extent that war production does not suffer. In other words, the new machine tool policy can be adapted to this field this way.

The selective relaxation would work to permit utility construction only to the extent that it did not put any added strain upon the labor supply in a labor-shortage area. If by using its own regular construction, maintenance and service crews the job can be done there should be no reason for holding it up. However, if the work was in a tight labor area and the utility had to contract outside for labor, then the work should be deferred.

It is hoped that OWU will recognize the need for some such interpretation of the new reconversion policy and find ways for a relaxation of utility purchasing and construction.

The Big Users of Electricity

A RECENT STUDY by Federal Power Commission of the energy requirements of industries gives the first national picture of the changes wrought by war demands. The big three—chemical, non-ferrous metals and iron—which in 1939 used 39 percent of the total for all manufacturing, are estimated to use 54 percent this year.

While all manufacturing was expanding its consumption from 1939 through this year a little over two times, chemicals were expected to be up three times and non-ferrous metals five times. The greatest expansion in use has been in transportation which in 1939 used 482 million kw.-hr. and this year is expected to use 16 times as much, or 7,635 millions.

Iron and steel which had first place as a consumer of kilowatt-hours in 1939 now is in third place and chemicals which was in second place before the war is now at the top of the list. The greatest jump is in usage by non-ferrous metals which in 1939 was in sixth place and now is in second.

When civilian loads return, many of the industries that changed place during the war will go back to where they were, but there may be some permanent changes. That, of course, will have to be determined later, but in the meantime the data, while estimates, are an interesting contribution to the industry's economic data.

Post-War Lighting Promotion

IN THE PREPARATION of the insert in this issue commemorating the tenth anniversary of Better Light—Better Sight a search was made for programs of national associations affecting the post-war development and sale of lighting. There are listed on one page those activities in which work is now under way or which have received the green light. But that is not all. In addition, there are several other programs now in the discussion stage without taking into consideration any of the individual programs of manufacturers.

A study of these activities cannot help impressing one with the strength of the promotional effect that will be back of lighting after the war. It is probably the most extensive promotion that lighting has ever had, as well as the most diversified. Not only that but every phase of it is being carefully planned with an eye to making it as effective as possible.

One is also impressed, however, with the fact that all of these promotions are for the common purpose of improving the quality and quantity of lighting, yet there is no over-all coordination. Surprisingly enough, the whole thing seems to hang together, yet it is conceivable that more might be accomplished when it comes time to put all these promotions to work if there were some simple coordinating body, if only for the purpose of assuring each group that it knew what the others were up to and why and how and when.

The Dealers Organize

WITH THE LAUNCHING of a drive for members in the new National Electrical Retailers Association, there is now no important group of the electrical industry that is unorganized. By not having a national association to speak for them, the dealers have never had representation of their own choosing in the preparation of any national promotional programs. In the post-war period this will be important because so much depends upon the whole-hearted dealer support of these national programs.

Not only that but by joint exploration on the part of national bodies the way may be found for a better understanding of the relationship of each to the other—their mutual inter-dependence. The dealer—supplier—service organization set-up of the electrical industry is different from anything found in the general run of retailing and for that reason much of the success of the operation in the electric appliance field depends upon an appreciation each of the other.

Also, when dealers are represented by organizations in which electrical retailing is but an incidental item, there is little likelihood that it will receive much more than casual interest, whereas in the new NERA the whole attention by being constantly focused on electrical selling will bring more considered action.

The formation of this new group more than ever accentuates the need for a national coordinating organization of some kind for the entire electrical industry. Manufacturer, wholesaler, contractor, dealer, utility—all are nationally organized yet there is no common meeting place for the discussion and resolution of common problems. Perhaps this new body may point the way because most of its problems will be matter for joint study with the branches of the industry.

Effect of Silicones on Apparatus Design

PROFOUND INFLUENCE upon the whole field of electrical apparatus design is certain to be the result of the new silicones recently announced. They afford an impregnant for Class B insulations which gives them opportunity to permit electrical functioning at temperatures well above those to which Class B materials with heretofore organic impregnants have been limited. The effect will show up in ratings, dimensions and insulation life of the equipment to which the relatively inorganic silicone is applied.

At least a hundred degrees centigrade higher in operating temperature is definitely assured and that is a large-scale upping of temperature from the 90-120 C. which has been the rule. In fact reports indicate that inorganic insulations like glass mica and asbestos will survive tests at 500 C. for many hours but sustained life is more safely assured at 250 or 275 C.

Not everything electrical, by any means, will justify such temperatures but there is a wide field where they have to be met as an ambient or can be justified as an internally generated temperature. Sizes can be reduced provided the starting torque is not sacrificed or the limitations imposed by the magnetic iron, the copper, the winding joints or the bearings are not exceeded. The new impregnants are manifestly "a natural" for dry-type transformers and motors for street-cars, mine-cars and steel-mill drives where temperatures, throughout or at hot spots, are high. The promise is that even the lowly iron and toaster cords will have prolonged life. What they can do for large electrical apparatus is to be demonstrated.

For the electrical engineer interested in associating electrical and thermal properties with the chemical origin of a plastic it can be said that silcones are silicated ketones with admixtures of favorable organic resins in advantageous proportions and polymer configurations. Essentially, the silicones are inorganic and derive their electric-thermal values largely from the processing which substitutes silicon (a nonconductor) for the chemical kindred carbon (a conductor) which sets the carbonizing limit for the more familiar organic resins. It has taken several years and the effective collaboration of several agencies (Dow Chemical, Corning Glass, Mellon Institute, Owens-Illinois, Dow-Corning and Westinghouse) to perfect the polymerization technique and achieve the objective.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

Trouble Ahead for High Grade Coal Users

REGARDLESS of what finally occurs in the over-all bituminous coal supply picture, it looks like there is a particular brand of trouble ahead for users of the high-grade special purpose coals produced principally in Districts 7 and 8.

If this develops—and it appears inevitable unless Germany can be defeated in time for the resultant war production slash of 30 percent or more to affect high grade coal consumption this winter—a substantial part of the electric power industry will be affected, for in normal times, approximately 20,000,000 tons of its coal or about one-fourth of its total annual requirements, comes from Districts 7 and 8.

Total production of this coal for the current coal year is estimated at 180,000,000 tons. This is down somewhat from earlier days. Total demand for the coal year ending next March 31 is estimated at 195,000,000 tons, divided as follows: Retail dealers, 60,000,000 tons; by-product uses and coke, 42,000,000 tons; industrial users, including electric utilities, 57,000,000 tons, and railroad and export, 36,000,000 tons.

Coal Diversion

The Solid Fuels Administration for War has two procedures, one in operation, the other forthcoming, for dealing partially with this deficit. It is diverting some of these high-grade coals away from electric utilities, and from railroads, to other users whose needs are more pressing. Also, it is preparing an order limiting deliveries of these coals for domestic use to 90 percent of the amount delivered last year. It is expected that the first may provide as much as 3,000,000 tons to users other than electric utilities and railroads which they otherwise would not get. The second, by cutting domestic use 10 percent, is expected to cut the deficit by 6,000,000 tons. If the diversions from electric utilities and railroads are not later replaced, that would cut the deficit by as much as 3,000,000 more tons, leaving it at 6,000,000 tons. This may well happen, in the opinion of some.

It might be argued that more of this high-grade coal should be diverted from domestic users, whose furnaces do not demand the excellent coal required by many modern industrial combustion plants. If it becomes obligatory to make more of these coals available for vital war needs, some such cut may be made, but the prospects in this field are limited. Any broad breakdown of established distribution patterns inevitably involves added transportation, and the prospect of shipping Illinois coal into West Virginia for domestic use to replace high-grade coal shipped to an Illinois war plant soon loses its attractiveness.

Great Lakes Gets Traffic

The burden on railroads has further complicated the matter, for it has required that every ton of coal which can be moved over the Great Lakes take that route. Thus, SFAW is trying to cram into a shipping season of about 34 weeks a region's coal supply for 52 weeks. This requires that high-grade coals which might now be going to utilities be diverted to the Lakes while they are open. While this summer deficit normally might be made up after Lake traffic has closed, and to some extent will be, electric utilities may not get all that they might expect, for through it all SFAW faces at least a 6,000,000-ton deficit of high grade coal.

Under the circumstances, the argument runs, utilities, whose summer loads are normally lighter than in winter, could help out by burning poorer grades of coal compensating for its inefficiency by using equipment which normally would not be required to carry summer loads. Not only would this save the best coals for winter loads, which demand peak efficiency from all capacity, but it would help insure that no producers of lower-grade coal stand idle this summer for want of orders, as has been true to some extent so far. In normal years, summer idleness of low-grade producers is inconsequential, but in these times, with every ton of coal vital, tonnage not brought above ground is gone forever.

They Don't Like It

Such a course is understandably unpopular with utility operating men because of its adverse effect on maintenance and operating costs. Furthermore, many utilities have considerable trouble locating lower-grade coal which is good enough to be used in boilers designed for high-grade coals. But there is no question that utilities which use low-grade coals to the best of their ability help a tight situation.

Another factor complicating the high-grade coal supply picture is the peacetime practice of some utilities of placing firm commitments for as little coal as possible, and buying their needs in excess of such amount when and as needed. Sound operating practice in normal times, this causes trouble today, for about the only free coal today is very low-grade, and companies which are unable to buy usable coal must call on SFAW for directives. The disrupting effect of directives is cumulative, spreading wider and wider as SFAW has to scurry around for coal to replace that originally diverted to meet the first directive.

Oil Supply

The "off-again-on-again" oil supply has contributed to the confusion. While it affects only District I, 17 Atlantic Coast states, and less than 25 plants therein, the amount of coal concerned is considerable. These plants were refused oil, then allowed to use it last November, refused it again two months later and allowed to use it again this spring. It now appears that oil for generation may again be shut off. It's nobody's fault, but it complicates the coal purchasing of the companies concerned.

NEWS OF THE WEEK

Bituminous Coal Picture Betters, SFAW Reports

Ickes Predicts Production of 610,000,000 Tons for Year, but Potter Tells Truman Committee Tonnage Will Reach 616,000,000, only 10 Million Tons Short of Goal—Anthracite Shortage of 5,000,000 Tons Remains

Revised production figures issued by the Solid Fuels Administration for War last week cut to 16,000,000 tons the bituminous coal shortage anticipated for the coal year ending next March 31, as Administrator Harold L. Ickes predicted production of 610,000,000 tons during the coal year.

Ickes' announcement was the first optimistic statement made by SFAW in months, and followed only by a few weeks an announcement that the deficit appeared to have risen from 20,000,000 tons to 30,000,000 tons.

His Deputy Administrator C. J. Potter, however, was reliably reported to have told the Truman Committee that SFAW expects production of 616,000,000 tons during the coal year, which would cut the anticipated deficit to 10,000,000 tons on the basis of requirements of 626,000,000 tons.

SFAW's recent release made no change in the anticipated anthracite shortage of 5,000,000 tons.

Ickes revealed that the bituminous coal industry had received occupational deferments for 3,860 men under 26 years of age, and Potter was reported to have told the Truman Committee that a substantial number of these will expire in August. Manpower losses in the bituminous coal industry were 4,000 men in March and April, Ickes revealed.

SFAW originally saw a bituminous coal deficit of 20,000,000 tons, predicting that production would not surpass 596,000,000 tons and requirements would reach 616,000,000 tons. Recently, the anticipated shortage was raised to 30,000,000 tons on the basis of requirements of 626,000,000 tons. Potter's statement that 616,000,000 tons should be produced is more in line with anticipations of industry representatives and more in line with SFAW's own production figures for the first half of 1944 than is the 610,000,000-ton figure announced last week by Ickes.

SFAW reports show production of 309,030,000 tons of bituminous coal during the 25 working weeks this year for which it has issued reports or an average of 12,361,000 tons weekly. Average for the comparable period last year, lowered by two severe strikes, was 11,165,000 tons. Production for 1944 is ahead of comparable 1943 production by an average of 1,196,000 tons weekly or 29,900,000 tons for 25 weeks.

Barring strikes for the remainder of 1944, which is considered a reasonable assumption in view of the War Labor Board's approval of the contract negotiated by SFAW Administrator Harold L. Ickes, this weekly production gain over last year should be lengthened during the last half, for in the last half of 1943, coal production was lowered by two other strikes of at least one work week's duration each.

Thus it is apparent that if weekly coal production throughout 1944 rests at or above the 12,165,000-ton mark, the deficit which last year came from stockpiles (20,000,000 tons used) will come from normal production this year.

SFAW recently revised its estimates of 1944 needs to 626,000,000 tons. If the present weekly average of 12,360,000 tons be maintained, a 50-week year would yield 618,000,000 tons, a deficit of 8,000,000 tons. Accordingly, Ickes asked miners to dispense this year with the vacation they won only recently. How widely his request will be complied with remains to be seen; but if the industry works a 52-week year at the present average weekly production level of 12,360,000 tons, the 52 week total would be 642,720,000 tons, or more than enough bituminous coal. Probably the result will be between the 618,000,000 and 642,720,000-ton figure, some coal people in Washington believe.

SFAW officials point out that the ability of the industry to produce an average of 12,360,000 tons weekly throughout the year is largely dependent on the industry's manpower picture, which they consider black. They argue that the emphasis on induction of men under 26 years of age robbed the coal industry of its best producers and that the men left in the mines are growing older and progressively less productive.

Draft Cuts Output Slightly

Some observers contradict the conclusion drawn from this obvious trend by pointing out that inductions of men under 26 have been proceeding at top speed for at least two months. During these two months, they point out, average weekly production has fallen only from about 12,390,000 tons to 12,360,000 tons. If the draft of young men were going to cripple bituminous coal production, they argue, it would already be much closer to doing so than SFAW's figures indicate.

Meanwhile, bituminous stocks of the electric power industry on June 1 were almost 1,000,000 tons above their May 1 level. On June 1, the industry had 15,713,000 tons. On May 1, 14,802,000 tons were on hand. Consumption by power plants during May was 5,851,000 tons, 3.9 percent above April. Average daily consumption in May was 188,742 tons, 15 percent above April daily use.

Average number of days' supply on June 1 for the industry was 83, four days ahead of the supply on May 1, but

30 days under the average number of days' supply on hand June 1, 1943. By regions, days' supply totals were as follows for June 1, 1944, May 1, 1944, and June 1, 1943, respectively:

New England, 106-91-160; Middle Atlantic, 75-69-104; Ohio, 60-59-83; Michigan, 82-77-157; Illinois-Indiana, 74-70-100; Lower Missouri Valley, 83-80-75; Lake Docks territory, 122-105-170; Southeast, 119-128-137; Southwest, Mountain and Pacific, 157-145-114; total, all regions, 83-79-113.

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American Utility Rights Cancelled by Argentina

The American & Foreign Power Co. for the third time this year suffered heavily at the hands of Argentine Federal commissioners when the commissioner in the Province of Corrientes recently cancelled the municipal concession under which Compania de Electricidad de Corrientes was operating.

Other subsidiaries in the Provinces of Tucuman and Entre Rios were expropriated this year.

Action against the Corrientes company was taken on the ground that its activities were "contrary to public interest." This charge was based only on the statement that "it had been found that the existence of this company was purely nominal and that it had no autonomy or freedom of action, being financed, directed and controlled by a foreign firm situated outside Argentina."

Southwest Drought Brings Added Power Demands

The current drouth is causing a record-breaking demand for electric power in several isolated areas of the Southwest, C. S. Lynch, executive vice-president of the Arkansas Power & Light Co. and chairman of the operating committee of the Southwest Power Pool, stated last week after a committee meeting.

"In Arkansas we are having an unprecedented demand for power for rice irrigation in the Grand Prairie around Stuttgart and Lonoke," Mr. Lynch said. "This year we are supplying more than 800 rice wells, an increase of about 100 over last year. That means an increase of more than 3,500 hp. in one area, which is served almost entirely from a 66,000-volt circuit, and it means a tremendous demand on this circuit."

Although all of the generating capacity obtainable has been added to various parts of the power pool, the increased load caused by war plants and hot weather has just about kept pace with this increase," he stated. In most instances, according to Mr. Lynch, the unprecedented demands are working hardships on certain lines that are being overloaded, and not on the overall generating plants.

The Arkansas-Louisiana-Mississippi system in which the Arkansas Power & Light Co. normally operates is supplying about 25 percent more power this year than it was supplying the same time last year, he said. In Arkansas alone the load is probably more than 25 percent above that of last year.

"The Little Inch" pipeline which started operating last December took from our system more than half of the amount of power the new Harvey Couch plant at Stamps can generate," said Mr. Lynch. Other increased war loads about totaled the remainder of the plant's output. New load demands brought on by the drouth have been piled upon these, and it has created a record-breaking demand on our system."

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Aluminum Freed by WPB for Use in Civilian Goods

Use of aluminum for civilian goods including many industrial items has been approved by the War Production Board. However any manufacturing done must not involve the use of manpower, materials or facilities needed in the war production program.

Three other orders to speed the reconversion program of industry are to be issued as follows: permitting manufacturers to make working models of the post-war items they hope to produce, July 22; allowing producers to acquire machine tools and other production machinery, Aug. 1; and permitting the production of civilian goods in any area where manpower or production facilities will not be taken from war production, Aug. 15.

Under the order use of aluminum is permitted in the manufacture of these items, parts, components, and subassemblies: cathodes for the electrolytic refining of zinc and cadmium, electric bus bars, conductors and current-carrying accessories, condensors, motors, switch gear equipment, industrial type lighting equipment, portable electric tools, repair and maintenance parts of electrical equipment, refrigeration and heating coils and fins.

Many other items are also included though in many cases clauses limit the conditions of manufacturing use.

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U-1 Addition Simplifies Material Procurement

Direction 2 to order U-1, allowing applications approved before June 10 to obtain and use materials on the same simplified basis that applies to applications approved after June 10 has been issued by the Office of War Utilities.

Under Direction 2, utilities are authorized to use the allotment number U-2 instead of specific quarterly allotments previously issued for controlled materials. The U-2 symbol may not be applied to orders for more than 100

INTAKE AT DENISON DAM—This intake structure controls the flood and power conduits of the Denison Dam, dedicated on July 1. Located 800 feet from the power house and stilling basin exit, the building is erected in the reservoir of the dam whose embankment can be seen in the background

tons of steel, 10,000 lbs. of copper wire and cable or 5,000 lbs. of aluminum wire and cable for specific jobs. Utilities are also authorized to use materials and equipment on authorized jobs in excess of the amounts specifically authorized for such jobs provided they are the same kind, type, size and capacity equipment and materials as were specifically authorized. This does not apply to poles, cross arms, transformers and meters, which are limited to the amounts specifically authorized.

Nothing in Direction 2 requires utilities to change orders already placed. It was emphasized that the direction constitutes no relaxation of standards for material use. It specifically forbids work on revoked or completed jobs and binds utilities to work only on the job described in the approved application. All special conditions attached to the original application as approved are continued, and the use of any kind, type, size, or capacity of material or equipment other than that specified in the approved application is forbidden.

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Yakima Votes P. P. & L. 20-Year Franchise

Regaining a portion of the ground lost several years ago, Pacific Power & Light Co. was voted a 20-year franchise by residents of Yakima, Wash., at an election held July 11.

Voters of Walla Walla, Yakima's sister town, rejected a similar proposal by a narrow margin.

With absentee ballots remaining to be counted, a tabulation of election results showed that Yakima voted 3,495 to 2,940 in favor of granting the franchise. Walla Walla refused a franchise by a vote of 2,117 to 1,958.

Election results will have little effect, however, on service in either community. When Pacific Power & Light's original franchise expired in the two towns several years ago, the utility continued to render normal service. Now that Yakima has granted a new franchise, however, plans call for the installation there of a new street lighting system.

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Boilers Use Coal or Gas

Alabama Power Co. has converted the boilers at its Chickasaw steam plant to utilize either pulverized coal or natural gas as fuel. Boilers at this plant were erected to operate on pulverized fuel exclusively. The transition from coal to gas or vice-versa can be accomplished in a few minutes.

Transformer Lack Bars New Line Construction

Shortage of Poles Precludes Liberalization of U-1 Order in Next Few Months Regardless of WPB Permission to Increase Civilian Production —Power Division Discusses Changes to Reduce Utility Paperwork

HIS WORK IS DONE—William O. Kellogg (right), supervisor in the distribution department, The United Illuminating Co., Bridgeport, Conn., receives a gift from President William C. Bell in recognition of Mr. Kellogg's service of 55 years and one month. He retired July 1. Starting as bill collector and office boy, Mr. Kellogg later served as lineman, dynamo tender, superintendent of electrical maintenance at Congress Street station, and as chief operator at the Steel Point plant when it went into operation in 1923. A company luncheon was tendered Mr. Kellogg.

Shortages of transformers and poles are expected to preclude any liberalization of line construction under order U-1 or its supplementary orders in the next few months regardless of the extent to which WPB permits manufacturers to put idle manpower and materials into civilian production, spokesmen for the Office of War Utilities said this week.

Discussion of changes in U-1 and its supplementary orders which would give automatic approval to many projects which now must be submitted on form WPB-2774—and which are almost automatically approved when so applied for —are under discussion by OWU's Power Division, but no action on them is anticipated for some time. It was emphasized that these changes, except in one relatively minor instance, would not represent any relaxation of the standards for line construction.

Effect of the changes would be to reduce appreciably paperwork by utilities and OWU.

Effect of Clash Unknown

To what extent the recent clash between WPB chairman, Donald M. Nelson and the joint chiefs of staff over the former's plan for limited resumption of civilian production on an even broader scale will affect other OWU programs, notably that for turbines and generators, was not immediately known.

Top OWU officials are discussing the problem posed by numerous requests for additional generating capacity which have been turned down previously because they just could not qualify under the rigorous standards on which power installations were judged. That some decision will have to be made relatively soon is obvious, for the capacity to make generating equipment is available, materials may be had to a moderate degree at least, and the demand is certainly there.

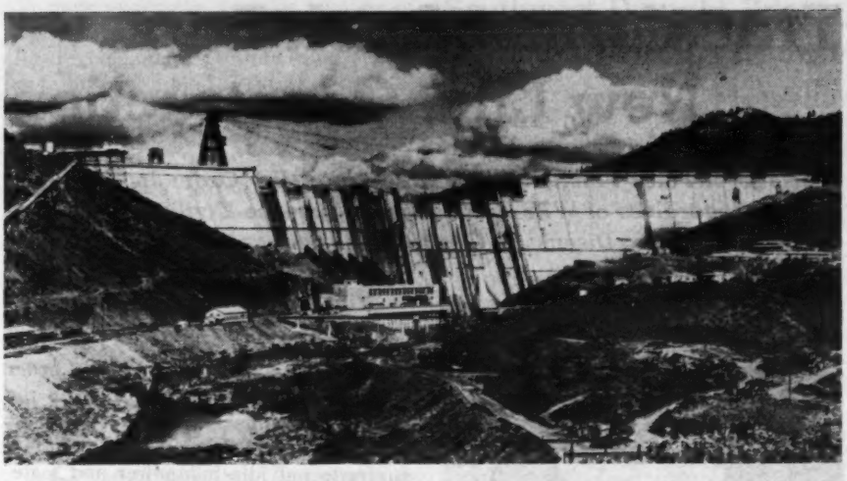
That equipment manufacturers want business is apparent from a statement by an Interior Department power spokesman, who told ELECTRICAL WORLD that manufacturers are urging it to exert all influence possible for the fabrication of equipment for numerous deferred Interior projects.

WPB Approves Additional 278,500 Electric Irons

Authorization for the manufacture of an additional 278,500 electric irons by four more manufacturers brought WPB's iron program this week to 2,037,838 units, slightly in excess of the program originally authorized.

Latest manufacturers authorized to make irons are the Siles Co., Circleville, Ohio, 5,000; Industrial Tool & Die Co., Minneapolis, 5,000; Birtman Electric Co., Rock Island, Ill., 93,500; and Chicago Electric Co., Chicago, 175,000.

Birtman Electric, being in a group II labor area (area of anticipated acute labor shortage) will be restricted to manufacture of 15 percent of its quota in Rock Island and has contracted with the Dominion Electric Co., of Galion, Ohio, to manufacture the remainder. Chicago Electric, in a group I area (area of acute labor shortage) has contracted for its entire output to be manufactured by Dominion.



SHASTA STARTS DELIVERY—Pacific Gas & Electric Co. takes 300,000 kw. from multiple-purpose Central Valley Project

Shasta Generators Operating Officially

Substantially increasing California's supply of electrical energy, two generators of 150,000 kw. capacity officially were placed in operation at Shasta dam, July 14, though actual delivery of power has been made to the Pacific Gas & Electric Co. since last June.

Keystone structure of California's multiple-purpose Central Valley project, Shasta dam, power house and Shasta-Oroville transmission line have been on an emergency construction basis.

When electrical installations are complete after the war Shasta power plant will have an installed generating capacity of 375,000 kw. developed from hydraulic turbines totalling 515,000 hp. The 75,000 kw. vertical shaft generators are connected to 103,000 hp. turbines with a solid steel shaft 42 in. in diameter and more than 35 ft. long.

Full deliveries of power to the P. G. & E., which distributes it under contract with the Government, will be made at the end of the current year.

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R. Lloyd Named Chairman Of House Wiring Group

R. L. Lloyd, associate electrical engineer, National Bureau of Standards, Washington, has been named chairman of a special committee to study and report on wiring methods and other National Electrical Code treatment of prefabricated houses. His appointment was announced by Alvah Small, chairman of the Electrical Committee of the National Fire Protection Association of which the special committee is a part.

Other committee members will be J. H. Arnold, National Board of Fire Underwriters, New York; R. F. Davis, American Telephone and Telegraph Co., New York; C. M. Fife, West Penn Power Co., Pittsburgh; C. A. Finkel, The Okonite Co., Passaic, N. J.; H. G. Knoderer, General Electric Co., Bridgeport, Conn.; W. J. Mahan, electrical inspector, New Haven, Conn.; W. R. Rilling, Underwriters' Laboratories, Inc., Chicago; Harry H. Steidle, Prefabricated Home Manufacturers' Institute, Washington; and Howard P. Vermilya, National Housing Agency, Washington.

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Detroit Rate Hearing Adjourned to July 24

Michigan Public Service Commission has adjourned the Detroit Edison Company's rate hearing to July 24 at the request of James H. Lee, assistant corporation counsel for the City of Detroit. This is the second adjournment in the present hearing.

The hearing results from the State Supreme Court's recent decision criticizing the commission's failure to adjust all utility rates so that federal excess profits taxes would be eliminated. The commission has interpreted the supreme court decision as meaning a public service company should not charge war taxes as part of operating expenses when determining rates.

Paul W. McQuillen, attorney for the company, at the July 11 hearing took exception to previous testimony by Richard A. Sullivan, city rate analyst, that rates could have been reduced $13,457,000 last year, eliminating the federal tax, and leaving a net income of $9,934,000.

"The minimum rate base and the maximum rate of return already are far below a fair rate of return," McQuillen said.

The Edison company began presentation of its evidence after the commission refused McQuillen's motion for dismissal, and after the City Ice & Fuel Co., represented by Howell D. Van Auken, of Detroit, an intervenor in the hearing, and the City of Detroit has rested their cases.

Charles R. Landrigan, assistant controller for Detroit Edison, testified that the average rate per kilowatt hour paid by residential consumers decreased from 3.42 cents in 1939 to 3.09 in 1943, after the company began offering step reductions as consumption increased. He declared the basic rate schedule is the same. During this period cost for commercial users, he said, dropped from three cents to 2.7 cents, and for industrial consumers from 1.198 to 1.09 cents.

Mr. Landrigan also testified that payment of the City of Detroit's 1943 excise tax on the amount the company pays in federal excess profits taxes, now before the Wayne County Circuit Court in a test to determine its validity, would result in a $1,737,000 deficit at the end of the year if rates were reduced to eliminate revenues on which excess profits taxes were paid, and if these taxes were not charged to operating expenses.

Van Auken, through testimony presented by J. N. Hepbringer, chief electrical engineer for the City Ice and Fuel Co., declared the Edison company's power rate was "discriminatory" and imposed an unduly high primary power rate. He criticized the "exorbitantly high minimums of the alternative power rate."

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FPC Sets Utility Hearing

The Federal Power Commission has directed the Public Service Electric and Gas Co., Newark, N. J., to show cause at a hearing why the commission should not order the company to adjust its plant accounts by almost $68,000,000 established as excess over original cost of facilities.

The hearing has been set for September 18 in the office of the Public Utility Commission of New Jersey, in Newark. The state board may participate.

•

Granted 25-Year Lease

A franchise covering the use of rights-of-way along all Kitsap (Wash.) County roads for the erection of power lines has been granted to the Kitsap County Public Utility District by the county commissioners. The franchise, good for 25 years, is to be exercised only in event the PUD decides to establish power service.

$500,431,671 Allotted to REA Since 1935

Since the start of the rural electrification lending program in 1935, $500,431,671 has been made available to Rural Electrification Administration for lending purposes up to the start of the 1944-45 fiscal year, REA has announced.

Of this amount, $13,931,671 came from emergency relief funds allocated to the program by executive order of the President in 1935. The remainder has been made available by Congress, either as direct appropriations or as authorizations for REA borrowing from the RFC. The Congressional authorization for REA loans in 1944-45 is $25,000,000.

REA loan allotments have been made to 875 borrowers. Up to May 31, 1944, the borrowers had been advanced $354,947,688 for construction of rural distribution lines; $13,480,875 for generating facilities; $11,046,797 for transmission lines and $6,044,038, which, under the Rural Electrification Act of 1936, REA borrowers can relend to individual consumers for wiring, plumbing and appliance installations.

From funds advanced, 813 borrowers on April 30, 1944 were operating 195,194 miles of rural power lines in 46 states, Alaska and Virgin Islands.

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Accredits Utility Courses

Increased cooperation between industry and higher education is seen in a program just established for Commonwealth Edison Co. by Illinois Institute of Technology under which certain courses conducted by the utility's industrial relations department are accepted for credit toward a college degree upon passing a college examination. Edison courses recognized by Illinois Tech total seven, all electrical engineering; four are undergraduate, three post-graduate, according to president Henry T. Heald, of Illinois Tech.

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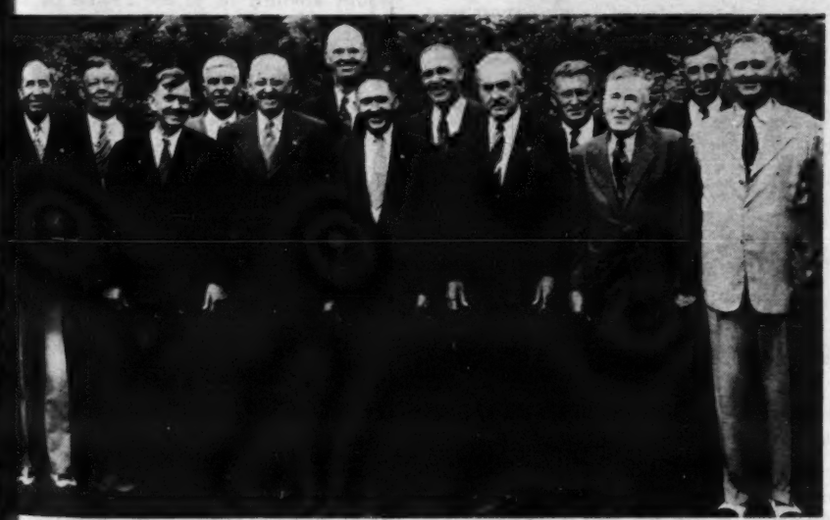
Labor Scarcity Threatens to Halt Ross Dam Work

Shutdown of work on the second step of Seattle (Wash.) City Light's Ross Dam, with a resultant loss of about 300,000,000 kw.-hr. of potential electric energy, is considered a strong possibility as a result of an acute manpower shortage in the Seattle area.

Warning that cessation of work on the $10,000,000 Skagit River power project may become necessary unless a higher manpower priority rating is granted for the job was contained in telegrams forwarded to Paul V. McNutt, chairman of the War Manpower Commission; President Roosevelt, Interior Secretary Harold Ickes and Donald M. Nelson, chairman of the War Production Board, by Congressman Warren Magnuson of Washington.

Pouring of concrete for the second step of the dam is slated for late summer or early fall. Lighting Superintendent E. R. Hoffman of City Light has already warned that in order to proceed with the work the contractor, General Shea-Morrison, will find it necessary at least to double the number of men now working on the project.



35 YEARS OR MORE—Foremen of 13 of the 16 districts of the construction and maintenance of lines department of the Duke Power Co. have been with the company 35 years or more. The veterans from left to right are O. A. McCall, G. C. Helms, A. L. Sides, L. E. Godwin, F. S. Neal, Jr., W. F. Grenshaw, J. C. Whitley, C. C. Kimbrell, J. D. Campbell, L. T. Upton, J. M. Massey, C. L. Knight and J. R. Wolfe

Surplus War Items Available to Utilities

OWU Attempting to Put Possible Buyers in Touch with Sources

War surpluses of items of use to electric, water and gas utilities are becoming available in increasing amounts, and the Office of War Utilities is attempting to put prospective utility buyers in touch with government disposal agencies.

Sales of war surpluses already negotiated have been tiny in comparison with the business done under OWU's inventory redistribution program, and probably less than $500,000 worth of business in war surpluses has been transacted so far under the new program, but it is anticipated that volume will increase. One of the largest transactions yet completed involved the sale of about 300,000 lbs. of cable to a West Coast utility by the Reconstruction Finance Corporation.

OWU is notified of available surpluses in which utilities might have an interest by RFC or one of its subsidiaries such as Defense Plant Corp. or Metals Reserve Corp. These agencies have been designated to dispose of specified surpluses by Will Clayton, Surplus War Property Administrator. OWU in turn notifies its regional engineer handling the territory in which the surplus is located, and utilities which might be interested are notified by the regional agency.

Avoids Price Negotiations

As in its inventory redistribution program, OWU stays out of price negotiations. Basic WPB policy appears to be that no company may be refused permission to buy material other than surplus if authorization to buy such material would otherwise be forthcoming, but it is not anticipated that many—if any—such cases will arise. Since government disposal agencies are not inflexibly committed to a policy of selling surpluses without loss to the government, price is open to negotiation and compromise.

OWU is discussing the surplus disposal situation with manufacturers in an attempt to keep its program on a basis which will be satisfactory to them as well as to the government and the utility industry.

Other government disposal agencies will report to OWU the existence of surpluses which might be of interest to the utility industry, although Clayton's division of responsibility for surplus disposal will insure that RFC and its subsidiaries will handle most utility items.

May Canadian Output Sets All-Time High

Central electric stations in Canada produced 3,584,815,000 kw.-hr. in May, the highest total of any month on record, the Dominion Bureau of Statistics has reported. It compares with 3,277,198,000 kw.-hr. in April and 3,511,201,000 kw.-hr. in May, 1943.

During the first five months of this year production totalled 17,203,640,000 kw.-hr., compared with 16,311,543,000 kw.-hr. in the corresponding period of last year.

Exports to the United States in May amounted to 242,128,000 kw.-hr., compared with 218, 542,000 kw.-hr. in April and 236,114,000 kw.-hr. last year, the total for the five-month period aggregating 1,050,300,000 kw.-hr., compared with 1,056,453,000 kw.-hr.

The figures released by the Dominion Bureau show what an increasingly important part Quebec's power production is playing. During the first five months of the year the province produced 10,029,644,000 kw.-hr., representing 58.3 percent of the entire Dominion output. In the corresponding period of last year the province produced 56.5 percent and in 1942 it produced 55 percent of the Dominion total. Ontario's contribution to total Dominion production, on the other hand, has declined in the past three years, output there in the first five months of this year being 25.7 percent of the Dominion total; 26.7 percent last year and 27.8 percent in 1942.

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FPC Interference Causes Resignation

Charging federal interference with the authority of the Indiana Public Service Commission as one of the reasons, William A. Stuckey has resigned from the commission and has been succeeded by Hugh Abbett, chief engineer for the commission since 1942.

In his letter of resignation to Gov. Henry F. Schricker, Mr. Stuckey, one of the two democrats on the commission, blamed especially the Federal Power Commission for interference declaring, "Many of the acts of this bureau within the several states, as I view them, are to set the stage ultimately for government ownership and control of all public utilities. This would be the end of private initiative in this field of business activity."

Mr. Abbett was first appointed in the engineering department of the commission in 1919 following his discharge from the army. In 1934 he became an engineer for a New York public utility consultant and in 1938 joined the Federal Power Commission where he remained until 1942.

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Southeastern President Reveals Section Leaders

Appointment of four section and committee chairmen of the Southeastern Electric Exchange for the ensuing year has been announced by President R. Paul Smith.

Those appointed are:

Accounting Section—Robert E. Howard, Jr., general auditor, Alabama Power Co., Birmingham.

Commercial Section—Hugh O. Isley, general sales manager, Carolina Power & Light Co., Raleigh, N. C.

Employee Activities Committee—Homer M. Pace, vice-president, South Carolina Power Co., Charleston.

Engineering & Operation Section—Henry B. Sargent, vice-president and general manager, Mississippi Power & Light Co., Jackson.

MEETINGS

International Association of Electrical Leagues—Annual conference, Detroit, Mich., September 20-22. O. C. Small, secretary, 155 E. 44th St., New York 17, N. Y.

Previously Listed

American Institute of Electrical Engineers—Pacific Coast technical meeting, Biltmore Hotel, Los Angeles, Calif., August 29-September 1. H. H. Henline, national secretary, 33 W. 39th St., New York 18, N. Y.

International Association of Electrical Inspectors—Northwestern section, Olympian Hotel, Olympia, Wash., August 21-23; E. B. Morrison, secretary, P.O. Box 70, Portland, Ore. Southwestern section, Modesto Hotel, Modesto, Calif., August 28-30; H. L. Gerber, secretary, Room 205, City Hall, San Francisco, Calif. Western section, Claypool Hotel, Indianapolis, Ind., September 11-13; F. H. Moore, secretary, 320 N. Meridian St., Indianapolis, Ind. Eastern section, DeWitt Clinton Hotel, Albany, N. Y., September 18-20; F. N. M. Squires, secretary, 85 John St., New York, N. Y. Southern section, Ainsley Hotel, Atlanta, Ga., September 25-27; A. M. Miller, secretary, 219 Governor St., Richmond 19, Va.

Edison Electric Institute—Accident prevention committee, E.E.I. headquarters, New York, N. Y., September 12-13. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

Illuminating Engineering Society—Annual convention, Edgewater Beach Hotel, Chicago, Ill., September 14-16. A. D. Hinckley, executive secretary, 51 Madison Ave., New York 10, N. Y.

Indiana Electric Association—Annual fall meeting, French Lick Springs Hotel, French Lick, Ind., September 20-22. E. F. Hauser, secretary-treasurer, 1414 Circle Tower, Indianapolis, Ind.

Association of Iron and Steel Engineers—Annual meeting, Wm. Penn Hotel, Pittsburgh, Pa., September 25-27. Brent Wiley, managing director, Empire Bldg., Pittsburgh 22, Pa.

Municipal Electric Utilities Association of New York State—Annual meeting, Lake Placid Club, Lake Placid, N. Y., September 26-28. T. J. McKee, secretary, 200 E. Third St, Jamestown, N. Y.

Consolidated Edison Petitions to Merge

Consolidated Edison Co. of New York, Inc., has petitioned the Public Service Commission for approval to merge with its utility subsidiary companies, taking over the assets and operations of Brooklyn Edison Co., Inc., New York and Queens Electric Light & Power Co., New York Steam Corp., Westchester Lighting Co. and Yonkers Electric Light & Power Co. The merger would not include the Consolidated Telegraph & Electrical Subway Co., owner and operator of an electrical duct system in Manhattan and the Bronx.

President Ralph H. Tapscott in the petition states that the company believes such a merger is in the interest of the consumers and of the public and that it "would bring about a corporate structure which would conform to operating reality."

The merger is expected to cut operating expenses and taxes.

It is proposed, unless the Public Service Commission should otherwise determine, to pay minority holders for each share of their stock in the subsidiary companies as follows:

Brooklyn Edison stockholders would receive $135; New York and Queens Electric Light & Power Co., $108.625 for preferred and $115 for common; New York Steam Corp., preferred, series A, $7 dividend, $82 and cumulative preferred, $6 dividend, $72, common, $10.

All of the outstanding stock of the Westchester and Yonkers companies is owned by Consolidated Edison. Total payments to minority stockholders would amount to $1,287,293.88 on the above basis, assuming that none of the minority stockholders demands payment for his stock upon a court appraisal.

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Union Plans Electronics Courses at Marquette

To train 700 men a year in electronics, the International Brotherhood of Electrical Workers (AFL) has established a national electronics school at the Engineering College of Marquette University.

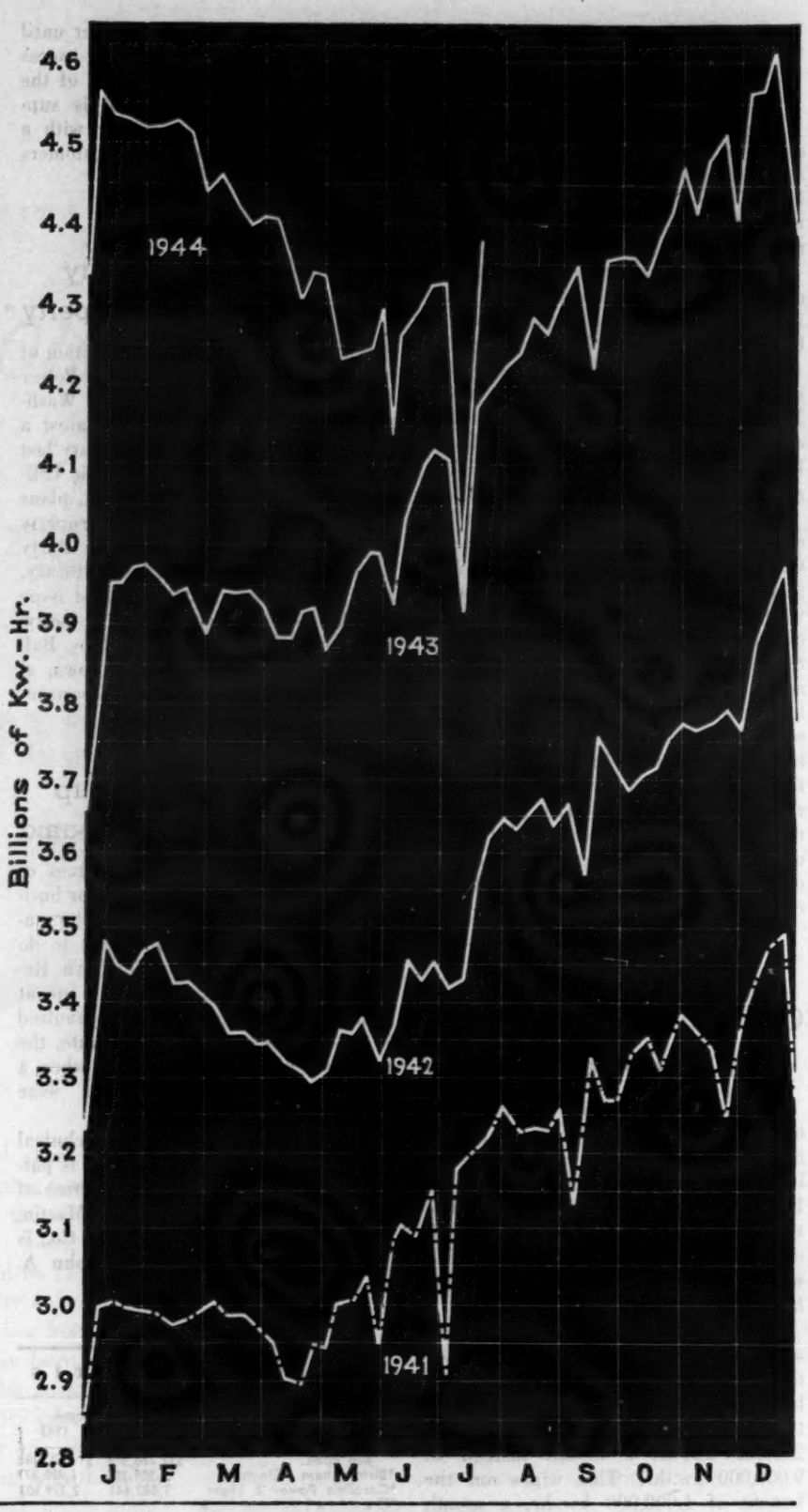
Each year eight intensive six-week courses will be given to eighty or more men who will return to their union locals as instructors. It is hoped that they will be able to impart their knowledge to some 25,000 other members each year.

Tuition costs of $30,000 a year will be paid by the international union, and locals will bear the cost of transportation and lodging.

Output Curve in Sharp Advance

Following the sharp drop in output registered during the holiday week ended July 8, the curve swung sharply upward during the week ended July 15, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry during the latter week amounted to 4,377,152,000 kw.-hr., compared with 3,940,854,000 kw.-hr. for the holiday week. Figures for the week represented an increase of 4.6 percent over the 4,184,143,000 kw.-hr. distributed during the corresponding week a year ago. The output for the similar week two years ago was lower, being 3,565,645,000 kw.-hr.

Four of the seven major geographic regions of the country reported increases for the week over the corresponding week last year. New England cut the loss of 12.0 percent reported for the week ended July 8, as compared with the corresponding week a year ago, to a loss of only 0.7 percent for the week ended July 15. The Central Industrial group converted the decrease reported during the holiday week —1.7 percent—into an increase of 3.3 percent for the week ended July 15.



Weekly Output Millions Kw.-Hr.

1944		1943		1942	
July 15	4,377	July 17	4,184	July 18	3,566
July 8	3,941	July 10	3,919	July 11	3,429
July 1	4,327	July 3	4,111	July 4	3,424
June 24	4,325	June 26	4,120	June 27	3,457
June 17	4,287	June 19	4,098	June 20	3,434
June 10	4,265	June 12	4,040	June 13	3,464
June 3	4,144	June 5	3,926	June 6	3,372
May 27	4,292	May 29	3,990	May 30	3,323
May 13	4,238	May 15	3,969	May 16	3,357
May 6	4,234	May 8	3,904	May 9	3,365
Apr. 29	4,336	May 1	3,867	May 2	3,305
Apr. 22	4,344	Apr. 24	3,925	Apr. 25	3,273

Percent Change from Previous Year

	Week Ending		
	July 15	July 8	July 1
New England	— 0.7	—12.0	+ 0.6
Mid-Atlantic	— 2.5	— 5.4	+ 0.1
Central Industrial	+ 3.3	— 1.7	+ 5.5
West Central	+ 4.5	+ 2.0	+ 5.7
Southern States	+ 9.2	+ 5.2	+ 8.2
Rocky Mountain	— 4.6	— 8.0	— 6.6
Pacific Coast	+17.6	+15.0	+15.6
Total United States	+ 4.6	+ 0.5	+ 5.3

Coast City Wants Outlet For Hetch Hetchy Power

Seeking to find an outlet for Hetch Hetchy electrical energy before August 28 when a Federal Court injunction becomes effective, (ELECTRICAL WORLD, July 1, 1944, p. 4), San Francisco's Mayor Roger D. Lapham and Public Utilities Commission President Marshall Dill were exploring early in July possible answers to the city's power problem.

Under an injunction complying with the Raker Act, the city is prohibited from selling power to the Pacific Gas & Electric Co. for resale to consumers. However, posed as possible solutions are city lease or purchase of the P. G. & E. distribution system. Both Lapham and Dill have been conferring with P. G. & E. President James B. Black.

It is expected the city's present Hetch Hetchy power market, an aluminum plant at Riverbank, Calif., will shutdown in the near future.

June Stream Flow Showed Variations

Contrasting conditions of floods and droughts marked the month of June, according to the report issued by the U. S. Geological Survey in collaboration with Dominion Water and Power Bureau (Canada).

Floods of destructive magnitude occurred for the third consecutive month in the west-central states, and floods of local extent occurred in New England, Alberta, and Utah. Drought prevailed in eastern Virginia and North Carolina. Noteworthy deficiencies in stream flow existed in southern Quebec, Ohio River Basin, upper Gila River Basin in Arizona, and in the Columbia River Basin.

The spreading of the drought in the central Appalachians and Atlantic Coastal States, centering in eastern Virginia and North Carolina, was in contrast to the relief from threatening drought conditions in the New England States. Throughout the whole East (excepting central New England) stream flow declined much more than usual for seasonal recession in flow, the decline being most marked in eastern Georgia, the Carolinas and Virginia. Although stream flow averaged 120 percent of normal in the ten most affected states during May, it averaged only 65 percent of normal during June, according to the report.

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Oil Ban Accentuates B. C. Power Famine

Non-essential industry in Vancouver may have to curtail operations almost immediately as a result of orders issued by the Federal Oil Controller to the British Columbia Electric Railway Co. steam plant at Vancouver to cut oil consumption by 75 percent. This would mean a reduction from 50,000 to 12,000 barrels a month.

The cut comes at a time when every available source of power is being used to meet the power shortage crisis caused by lack of water. With the reduction the steam plant can produce but 2,250,000 kw.-hr. a month instead of 9,000,000 kw.-hr. This wipes out the benefit of 1,000,000 kw.-hr. a month which are being bought from the Puget Sound Power & Light Co. and being brought into Vancouver over a special line from Bellingham, Wash.

Meanwhile, excess power from Britannia Mining & Smelting Co., plant at Britannia, Howe Sound, is also being brought into Vancouver.

The Lower Mainland will continue to get power from across the border until the Puget Sound Co.'s power excess is used, probably until the end of the year. In turn, B.C.E.R. Co. is supplying the American company with a small amount of power for its customers at Point Roberts.

•

PUD in Clallam County to Take Utility Property

Without waiting for the disposition of the appeal of the Puget Sound Power & Light Co. now pending in the Washington State Supreme Court against a $600,000 valuation verdict of a jury last December, Clallam County Public Utility District, Port Angeles, Wash., plans to take title to the company's property in the county during the next thirty days. Paul Coughlin, PUD attorney, said proceeds of a $700,000 bond issue will be used to pay for the property. The bonds will be purchased by Ballard-Hassett Co., Des Moines, Iowa, at an average interest rate of 3.27 percent.

•

Research Institute Set-up at Birmingham, Alabama

To develop the natural resources of the South and provide facilities for business organizations throughout the nation who lack proper equipment to do their own research, the Southern Research Institute has been set up at Birmingham, Ala. Originally organized as the Alabama Research Institute, the name was changed last month when a new constitution and by-laws were adopted.

The Institute will engage in technical research on a contract basis and is patterned largely after Mellon Institute of Industrial Research. Thomas W. Martin, president of the Alabama Power Co., is chairman of the board, and John A. Maguire is secretary.

Utility Reports

	Net Income 1944	1943
*American Gas & Electric and subs.	$11,770,316	$11,103,084
*Birmingham Electric	1,239,385	1,400,877
*Carolina Power & Light	2,582,641	2,379,303
*Central Arizona Lt. & Pwr.	850,152	953,661
†Central Maine Power	3,222,316	3,413,426
*Florida Power & Light	2,512,795	2,121,594
*Kansas Gas & Electric	1,430,872	1,514,171
*Minnesota Power & Light	1,856,949	1,899,317
*Montana Power and subs.	4,327,092	3,748,284
*Pennsylvania Power & Light	5,668,576	5,851,372
*Puget Sound Power & Light and subs.	5,425,393	4,167,745

*Twelve months ended May 31.
†Twelve months ended June 30.

California Group Rejects Offer of Pacific G. & E. Co.

Latest offer of the Pacific Gas & Electric Co. to install transmission lines and deliver electricity to an area in Fresno County, Calif., has been turned down by the Foothill Electric Association, it was revealed recently, with the announcement the association will proceed with its own program to provide power to the rural section.

The association has contracted with the Federal government for $260,000 in Rural Electrification Administration funds to construct the project. Negotiations for supplying electricity to the area were begun in 1941 after the P. G. & E. had refused to supply electric service, according to Rue C. Gibson, Fresno, attorney for the association.

Since that time, the power utility has made three offers to install lines, Gibson said. The first two were refused because consumers would have to pay construction costs, and the third was turned down since it did not guarantee service to all members of the association.

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Discuss Plan To Expand Utility's Power Lines

City commissioners at Bartow, Fla., discussed expansion of municipally-owned utility facilities to meet increasing demands for electricity and water.

Extension of a power line to the new Kingan & Co. meat packing plant was authorized. The plant, located on the Fort Meade road, will have a demand load greater than the capacity of the present line and City Manager H. P. Ford recommended construction of a new line as more satisfactory and less expensive than building up the present line. Cost is estimated at $3,000 based on a rate of $600 per mile.

John Peeples, power plant superintendent, said equipment will supply present demands. Two turbines are used for peak loads with a small turbine in reserve. A report showed 2,180 electric meters as of Jan. 1 and 115 installations up to June 1, making a total of 2,295. Commissioners anticipate that there will be a need for new production capacity in the near future.

•

Gets Extra Power Source

With the completion of a substation in September, Danville, Va., will be able to avail itself of Appalachian Electric Power Co. energy in case the city's hydro-electric resources in nearby Patrick County fail.

The 10th Anniversary

of

BETTER LIGHT - BETTER SIGHT

or

A PRELUDE TO THE RELIGHTING OF AMERICA

ELECTRIC LIGHTING started the central station industry over sixty years ago. Electric lighting was instrumental in speeding up the recovery of the central station industry from the depression—so much so that it was the first major industry to exceed its 1929 sales.

Ten years ago when the electric utility and all other businesses in this country were scraping bottom the Better Light Better Sight program was born. Prior to that time lighting, although still the backbone of the business, had been nosed out in utility sales promotions by loads that had more customer appeal. There wasn't much that was exciting in selling something to dispel darkness. Certainly there wasn't much additional load possibility.

By coupling an educational and promotional program to the science of seeing lighting the whole picture changed. There was a new public appeal and the load potentials were jumped.

Since the Better Light Better Sight program was launched new light sources have come into the field offering possibilities generally undreamed of ten years ago. They have rendered the larger part of our lighting obsolete so Better Light Better Sight has a new job to do after the war—relight America.

This insert, which is a tribute to the first decade of Better Light Better Sight, not only looks back upon the past ten years of accomplishment but asks its readers to look ahead for another ten and contemplate the fruits of relighting America.

What would it mean to the public, to those who buy electric service, to those who sell electric service, to those who make the equipment?

It isn't all millions of dollars of new equipment and lamps and kilowatt-hours—it's greater industrial production, improved shopping, speedier education and fewer accidents—all from better vision.

The first ten were splendid—the ten to come can contribute even more.

TEN YEARS OF BETTER LIGHT—BETTER SIGHT

H. P. J. STEINMETZ, *Chairman Executive Committee, National Better Light Better Sight Bureau*

LOOKING BACKWARD to 1933, one thinks broadly of that year as a low point in our economic history. Banks were closed, factories were shut down, and there were millions of unemployed. Specifically it was a year of steadily declining revenues for the electric utilities.

It was in June of 1933, that Edison Electric Institute held its first national convention at Chicago. One of the speakers on the program was George E. Whitwell, vice president, Philadelphia Electric Co., and then chairman of the General Sales Committee of the Institute.

In a forward-looking message, Mr. Whitwell said,—"Would it not be a marvelous thing for the electrical industry as a whole if, next fall, every electric utility in the United States, for a period of four, six or eight weeks, would intelligently campaign the sale of light?

"Is there any one thing that the utility industry could do as a whole that would bring back revenue more quickly than, over a sustained period, to resell the entire general public the value of the use of light? The American people, today as always, will spend money to obtain value. Forced economy has made millions of people forget the value of light. Why not a national selling campaign on light next fall—each utility doing its own job in its own territory, in whatever is the best way in that territory."

It was suggested that Mr. Whitwell's proposal be supplemented by an educational program built up on scientific facts on the relationship of light and sight.

The response to these suggestions was spontaneous. A special committee of utility lighting men was immediately appointed with Merrill E. Skinner, vice president, Buffalo Niagara & Eastern Power Corp., as chairman. A slogan, "Better Light Better Sight," expressive of the objectives of the movement, was adopted. By the end of that fall over 250 utilities had or were conducting educational programs on lighting in relation to seeing tasks. The results were surprisingly successful, so much so that the entire lighting industry was stimulated to intensify its efforts.

It was immediately realized that a vehicle must be provided to coordinate efficiently the activities of these various groups. Hence the formation of the national Better Light Better Sight Bureau, sponsored by some 18 organizations representing not only those directly interested in the lighting business but also other groups, such as the optical, paint, insurance, and retail merchandising interests. An organization meeting was held on August 6, 1934 and Mr. Skinner was elected chairman and M. J. Julian, president of the Better Vision Institute, vice chairman.

Science of Seeing

Through the stimulus of the bureau came the first public introduction of the Science of Seeing and the first full interpretation of the slogan—Better Light Better Sight—to the public.

The I. E. S. lamp—scientifically designed and certified—was introduced by the Illuminating Engineering Society's Industrial and School Lighting Committee to the electrical industry. Thee Better Light Better Sight News was started, disseminating news and information among the allied interests.

In 1935 the three-light lamp bulb made its appearance. The light meter for measuring foot-candles in convenient size was introduced. That year also saw the advent of the home lighting advisor, especially trained to discuss the broad principles of Better Light Better Sight. Home Lighting Departments were set up by many utilities. Lamp bulb sales—a good indication of the use and desire for light—had jumped from a low of 339,000,000 in 1933 to 412,000,000 in 1935. Local Sight Saving Councils and Better Light Better Sight Bureaus were formed—86 during the year.

In 1936 the introduction of the light selection recorder began intriguing thousands who found their eyes asking for 100 to 200-foot candles of light to see most easily. The original I.E.S. study lamp had been extended to include table and floor models for the living room. I.E.S. lamp sales had soared to a total of 3½ million. Save Your Vision Week was participated in by hundreds of utilities in cooperation with the optometric fraternity. The Light Prescribing Technique was introduced by the Better Vision Institute to aid members of the opthalmologic professions in educating their clients on proper light. Over 2,000 Home Lighting Advisors were by this time spreading the gospel to utility customers.

In 1937, bulb sales reached 506,000,000 and pin-to-

RETROSPECT

Helping to make the Better Light Better Sight program effective have been—

- **Science of Seeing**
- **I.E.S. Lamp**
- **Pin-It-Up Lamp**
- **Light Meter**
- **Home Lighting Advisor**
- **Three Light Lamp Bulb**
- **Local Sight-Saving Councils and Better Light Better Sight Bureaus**
- **Light Selection Recorder**
- **Light Prescribing Technique**
- **Fluorescent Lamp**
- **Sight for Victory Program**

PROSPECT

Educational program on relationship of proper lighting to comfort, health and efficiency of school children to be used by teachers for classroom study

Specifications on portable lamps and residential luminaires as basis for manufacturers' certification program

Lighting plans and suggestions for residential architects

Specifications for commercial and industrial luminaires as basis for certification program

Coordinated training programs and educational promotions in commercial and industrial lighting

Motion pictures

Consumer booklet

Newspaper advertisements

Local lighting institute booklet

Sound slide film on street lighting

wall lamp sales had totaled over 3,000,000.

By 1938 over 5,000 light meters were out working. Five million homes had been visited by home lighting advisors.

Beginning with 1942 and up to the present, developments commercially have been severely handicapped due to the war limitations, but Better Light Better Sight has marched on steadily. This is a fact borne out by the remarkable improvement of the lighting and seeing conditions in thousands of our war plants to which the Sight For Victory program of the Better Light Better Sight Bureau contributed substantially.

On the occasion of the tenth anniversary of the Better Light Better Sight movement and in view of its accomplishments, can there be doubt of its success and of its contributions to public and participants alike?

The Future

If there was any justification in the past for promoting Better Light Better Sight, there is even more in the future.

With the post-war period in mind, the bureau now has two new committees organized and functioning actively. One is a Home Lighting Education Committee, the other a Commercial and Industrial Lighting Education Committee.

The Home Lighting Education Committee, under the able chairmanship of Harry Restofski of West Penn Power Co., has under way an educational program on the relationship of proper lighting to the comfort, health, and efficiency of school children to be used by school teachers for classroom study.

Before proceeding with this project and to be certain that it would be acceptable and useful to school authorities, a canvass of a large number of school administrators was made. Some 140 school superintendents and principals from all sections of the country replied, giving full endorsement to the project. The Committee therefore is proceeding with its work. It is anticipated that this will be the most comprehensive project of its kind ever made available to schools.

Other projects being studied and developed by this committee are: specifications on portable lamps and residential luminaires, with which the manufacturers can work out a satisfactory certification program, and plans and suggestions on lighting to be presented to architects and builders of the mass of new homes expected to be built in the post-war era.

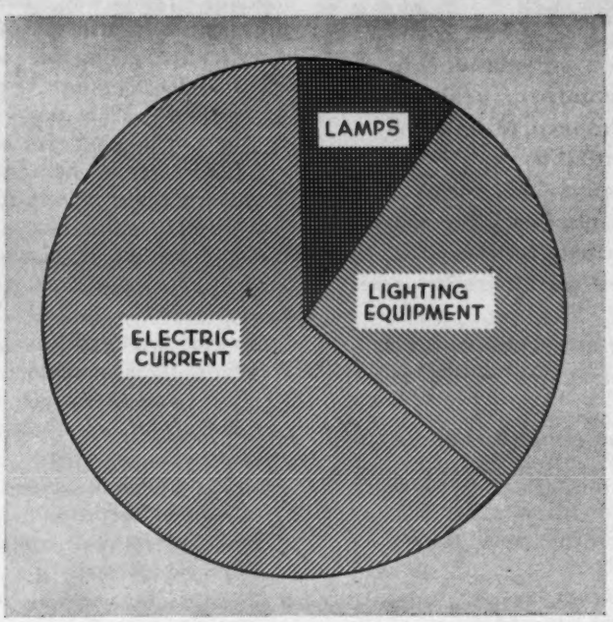
From the Commercial and Industrial Lighting Education Committee under the energetic leadership of J. S. Schuchert, of Duquesne Light Co., constructive action is anticipated at an early date on matters pertaining to such things as (1) specifications for commercial and industrial luminaires bearing on safety, good construction, and control of excessive brightness; developed primarily for standardization of equipment; (2) providing suggestions for a plan of sponsoring and administering of such specifications, coupled with an effective certification program; (3) coordinated training programs so that they can be organized and dovetailed for effective use, and (4) preparation of educational promotions that can be used constructively on a national level and will lend themselves to local tie-ins.

Motion Picture

Also under study by the bureau at present are: production of a high-grade sound-on-film motion picture and a supplemental series of charts with accompanying talks; a consumer booklet emphasizing the fundamentals of Lighting For Seeing and visualizing the benefits of Better Light for Better Sight; a series of professionally prepared newspaper advertisements, designed for immediate post-war use; and a booklet stressing the value of local lighting institutes.

In recent months much has been said and written indicating that there is some far-sighted thinking taking place among utility engineers looking to a new era in street lighting as war restrictions diminish. The Bureau has started on production of a sound-slide film adapted to educational lines as one contribution to greater development in this field.

Better Light Better Sight has been and is an educational, social service and market building enterprise. Its acceptance by the public and the lighting industry and its continued assurance of success is based on the fact that it meets a human need and, in meeting that need, it performs a genuine service to the public. But, after all, the Better Light Better Sight Bureau can only forge ideas and selling tools; how effectively those ideas and selling tools are used and if they are used depends on local action by all interests concerned. The bureau will be ready with ideas and tools for the post-war market. Will the industry be ready to use them? Judging by the wide interest expressed, we in the bureau believe it will be, and that another decade of even greater achievement is about to begin.



$1,500,000,000
The estimated annual lighting market, including energy sales, by 1948. In 1939 it was half that amount.

THE NEXT FIVE YEARS

D. W. ATWATER and J. L. KILPATRICK *Illuminating Engineering Department, Westinghouse Lamp Division, Bloomfield, N. J.*

RELIGHTING OF AMERICA in the second decade of Better Light Better Sight does not seem like an impossible task. Even the next five years, which is as far as our studies have taken us, will show the industry a long way forward toward that goal, with momentum picking up each year.

The data on these pages, which have been gathered from many sources and checked and rechecked, indicate that by 1948 the total lighting market, including light sources, equipment and energy, will reach an annual figure of one and a half billion dollars. In 1939 it was somewhere between 700 and 800 million dollars.

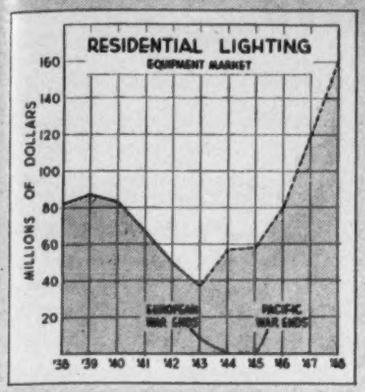
Large as these estimates are, however, they can not only be attained but they can be surpassed—but only if all the elements that go to make up the lighting industry are willing to work together toward a common objective. That objective must be big and should be planned.

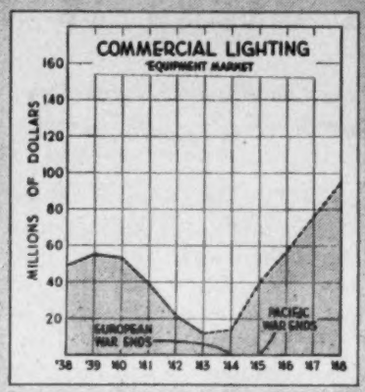
If we are to relight America we must have a larger and better trained lighting sales personnel. Pre-war around 3,500 people were selling lighting in this country. The development of the business here indicated will need a sales force two or three times larger, nearly all of which will need training.

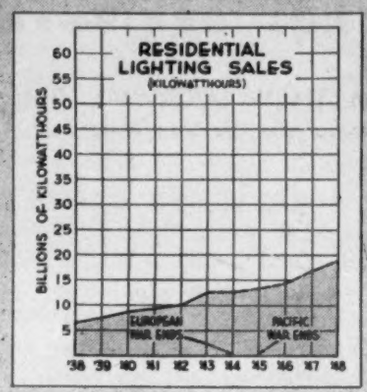
The estimates on these pages include both the relighting and the new lighting market on the national level. All post-war planning, however, must be at the local level where sales possibilities are not the same throughout the country. Nevertheless, in all localities there is a common motivating force which must be the utility because it has the largest stake in any operation of this kind. The degree to which its influence and manpower and money are placed behind a program to relight its area will determine the extent to which America will be relighted at the end of the second decade of Better Light Better Sight.

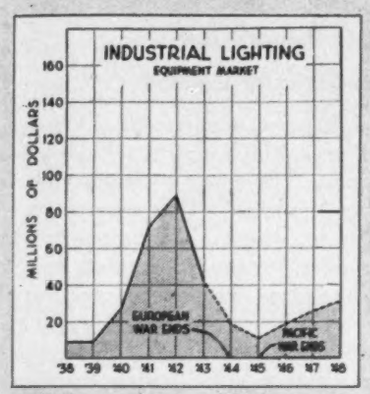
The Lighting Market Exclusive of Energy Sales

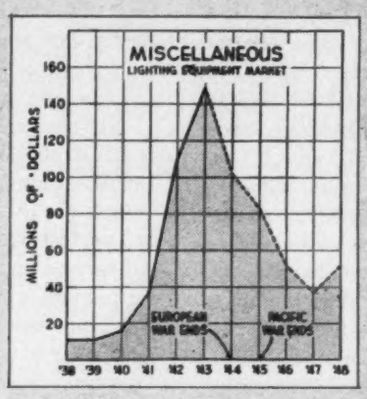
Year	Lighting Equipment				Light Sources	Total
	Residential	Commercial	Industrial	Miscellaneous		
1944	50,000,000	15,000,000	16,000,000	100,000,000	300,000,000	481,000,000
1945	60,000,000	50,000,000	9,000,000	75,000,000	325,000,000	519,000,000
1946	90,000,000	75,000,000	13,000,000	40,000,000	350,000,000	568,000,000
1947	120,000,000	100,000,000	21,000,000	30,000,000	425,000,000	696,000,000
1948	150,000,000	120,000,000	26,000,000	40,000,000	500,000,000	836,000,000

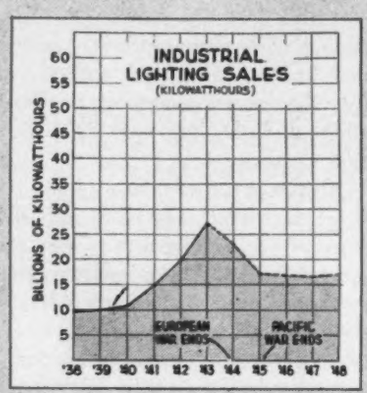

RESIDENTIAL LIGHTING
EQUIPMENT MARKET
MILLIONS OF DOLLARS
EUROPEAN WAR ENDS
PACIFIC WAR ENDS

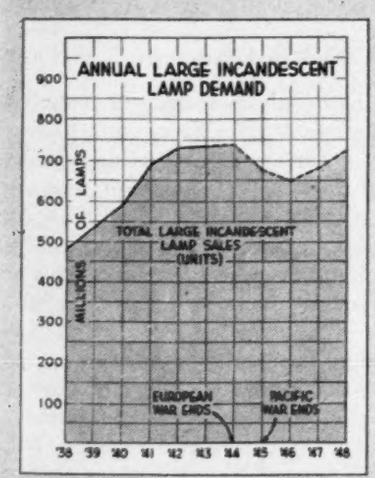

COMMERCIAL LIGHTING
EQUIPMENT MARKET
MILLIONS OF DOLLARS
EUROPEAN WAR ENDS
PACIFIC WAR ENDS

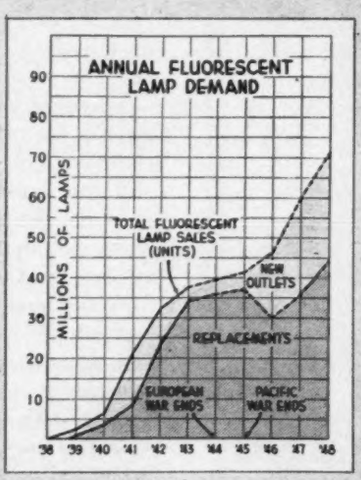

RESIDENTIAL LIGHTING SALES
(KILOWATTHOURS)
BILLIONS OF KILOWATTHOURS
EUROPEAN WAR ENDS
PACIFIC WAR ENDS

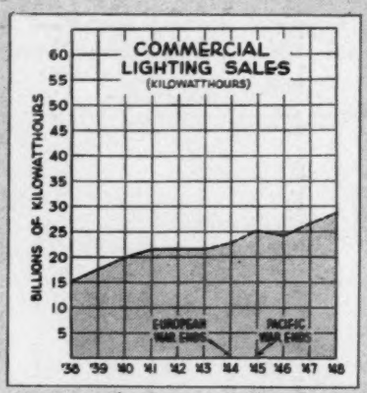

INDUSTRIAL LIGHTING
EQUIPMENT MARKET
MILLIONS OF DOLLARS
EUROPEAN WAR ENDS
PACIFIC WAR ENDS

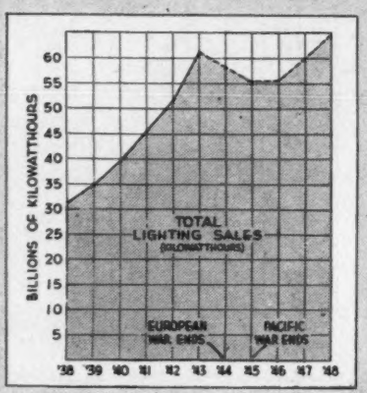

MISCELLANEOUS
LIGHTING EQUIPMENT MARKET
MILLIONS OF DOLLARS
EUROPEAN WAR ENDS
PACIFIC WAR ENDS


INDUSTRIAL LIGHTING SALES
(KILOWATTHOURS)
BILLIONS OF KILOWATTHOURS
EUROPEAN WAR ENDS
PACIFIC WAR ENDS


ANNUAL LARGE INCANDESCENT LAMP DEMAND
MILLIONS OF LAMPS
TOTAL LARGE INCANDESCENT LAMP SALES (UNITS)
EUROPEAN WAR ENDS
PACIFIC WAR ENDS


ANNUAL FLUORESCENT LAMP DEMAND
MILLIONS OF LAMPS
TOTAL FLUORESCENT LAMP SALES (UNITS)
NEW OUTLETS
REPLACEMENTS
EUROPEAN WAR ENDS
PACIFIC WAR ENDS


COMMERCIAL LIGHTING SALES
(KILOWATTHOURS)
BILLIONS OF KILOWATTHOURS
EUROPEAN WAR ENDS
PACIFIC WAR ENDS


TOTAL LIGHTING SALES
(KILOWATTHOURS)
BILLIONS OF KILOWATTHOURS
EUROPEAN WAR ENDS
PACIFIC WAR ENDS

WHAT RELIGHTING MEANS TO VISION

MATTHEW LUCKIESH, *Director, Lighting Research Laboratory*
General Electric Co., Nela Park, Cleveland

IN OUR CIVILIZED WORLD, so overwhelmingly engaged in seeing, upon which the efficiency, safety, comfort and welfare of human beings depend, there is as yet no profession of seeing specialists. Eyesight specialists take care of vision chiefly in their offices and surgeries. In general, they do not deal with the countless visual tasks and variety of seeing conditions in our everyday world of seeing. They see the results of over-burdened and abused eyesight, but they are not intimate with the world of prolonged critical seeing where human beings are enslaved by near-vision and suffer the consequences of prolonged critical seeing, inadequate light, improper lighting, and generally poor seeing conditions.

With the great advances in the production and control of artificial light and the development of the science of seeing, lighting specialists and various components of the lighting industry awakened to new and great opportunities to serve civilization. A great movement—Better Light Better Sight—was initiated.

However, the science of seeing is relatively new. Almost everywhere seeing can be made better, safer and easier.

At present lighting specialists are the only individuals whose practice takes them everywhere in the world of seeing where light makes seeing possible. But they must acquire and apply the knowledge available and their practices must have a scientific foundation if they are to be sound and incontrovertible. They must know how light serves eyes and the entire human being. They must know the penalties of poor lighting and the rewards of good lighting. They must avoid and denounce selfish commercialism and quackery. Only by serving public welfare best can they serve themselves and their industry best.

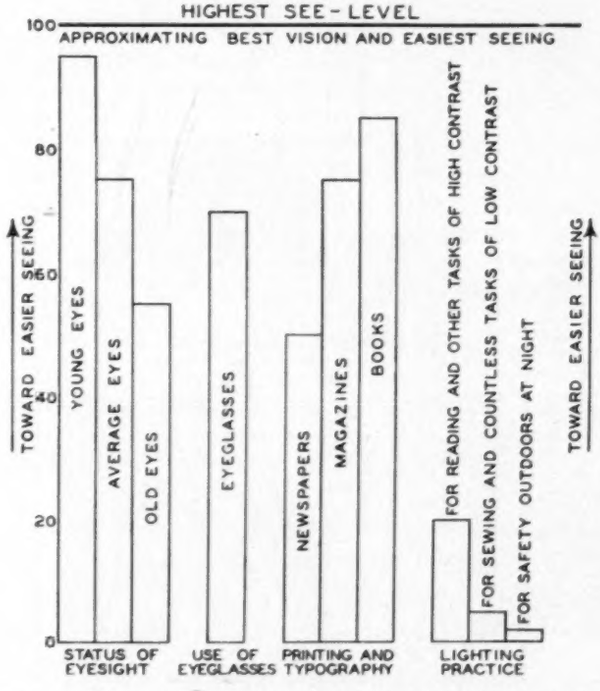


Fig. 1—Glimpses of the status of eyesight and of the lag in the full usage of some aids to seeing, including the essential aid and partner—light.

The Status of Lighting

The neglect of lighting as a universal aid to seeing is illustrated by Fig. 1 which charts relatively some familiar aids to seeing. The upper horizontal line represents the desirable "see-level." Most very young eyes are perfect or nearly so. However, average eyesight is subnormal and for older persons is even more so. Such an obvious aid to seeing as eyeglasses is not worn by many persons who need them. In the work-world many who wear eyeglasses have them fitted to their eyes for "normal" reading distance even though their actual "work" distance is not the common 14 inches.

The optimum size of type is rarely used in typography excepting for books for young children. Progress has been steadily made toward using larger type. However, the size of type commonly in use is appreciably less than the optimum for easiest reading by adults.

The Visual Task

Compared with these and other aids to seeing, lighting practice, as represented by foot-candle-levels, is very far behind. For such tasks as reading, a reasonably desirable foot-candle-level is at least five times that commonly available. Actually the optimum level —assuming good lighting as well—is above 100 foot-candles for maximum ease of seeing. For sewing and countless other tasks involving low reflection-factors and low contrasts of fine details with their backgrounds, the optimum levels of illumination are generally far above 100 foot-candles. Many of these are as high as 1,000 and some reach to 10,000 foot-candles —or full sunlight and skylight in mid-summer. These foot-candle-levels are dictated by researches, techniques and measurements which are an established part of the science of seeing. For such tasks artificial lighting is only at the primitive stage.

In this very complex realm of seeing fitting light to the visual task and to the eyesight involved can only be accomplished by measurements of visibility of the task and knowledge of the physiological effects of seeing. It is ridiculous for one to assume that he can

determine by mere inspection the foot-candles necessary for attaining a certain "see-level" or degree of visibility and easy seeing.

Fallacies of Foot-candles

The primary functions of light are to produce brightness and to reveal color. In fact, all that we see are brightnesses and colors, and brightnesses are by far the most important. Still, lighting practitioners are just beginning to consider brightness seriously and relatively few measure it. The fallacies of foot-candles must be understood and the foot-candle must be relegated to the secondary place where it belongs.

In Fig. 2 are illustrated three diffusely reflecting surfaces—white paper, gray cloth, and black velvet. Their reflection-factors are 80, 8, and 0.8 percent, respectively. Illuminated by 100 foot-candles their brightnesses are 80, 8, and 0.8 foot-lamberts respectively. If they are all to be of equal brightness of 80 foot-lamberts—equal to that of a so-called white surface illuminated by 100 foot-candles, as at a window in the daytime—the levels of illumination must be 100, 1,000 and 10,000 foot-candles, respectively. Thus it is obvious that the brightness of a diffusing surface is the product of the foot-candles upon the surface and the diffuse reflection-factor of the surface. This all-important fact must be recognized if light is to be fitted to the task and if lighting is to be properly appraised. The foot-lambert must generally supplant the foot-candle as the first consideration in the scientific appraisal and specification of foot-candles. Similarly brightnesses and brightness distribution are the basis for the diagnosis and specification of lighting and of seeing conditions.

Actually the fitting of light—foot-candles—to the great variety of tasks results in an enormous range of foot-candle-levels. It is obvious from the general absence of such a range in lighting practice at the present time that millions of persons are performing prolonged tasks of seeing with only an insignificant fraction of the aid that light can render them. As a result their eyes are carrying great burdens and the penalties are unnecessary eyestrain, eye-fatigue, bodily fatigue, and nervous tension. All this means a needless waste of human resources. Obviously a blanket specification of 10, 20, 50, or 100 foot-candles of general illumination is not a scientific or adequate approach to lighting for seeing.

The Science of Seeing

All problems of critical seeing can be divided into two broad aspects or viewpoints. One is the visibility of the task which is influenced by many factors but always by light and lighting. The other is ease of seeing, which is measured by deep-seated and, for the most part, unobvious and accumulative effects of seeing. Among these are eyestrain, eye-fatigue, nervous tension, bodily fatigue, and various wastes and accumulative effects in the muscular, neural, and mental realms of the entire human machine.

Eons of adaptation to Nature's outdoor environment lead to certain conclusions. A primary one is that brightnesses of common areas outdoors, such as green grass, soil, growing crops, and sunlit trees, are commonly of the order of 300 or 400 foot-lamberts. Owing to the low reflection-factors of these areas, these are the brightnesses resulting from levels of illumination of 5,000 to 9,000 foot-candles. We should be reasonably adapted to the common brightnesses of outdoor areas which confront us rather intimately for most of the year. We can scarcely accept the great principles of evolution and adaptation for everything else and

Fig. 2—The primary purpose of light is to produce brightness. Under the same illumination—100 foot-candles—the brightnesses of these diffusely reflecting surfaces are proportional to the reflection-factors, respectively. The left-hand surface is 100 times as bright as the right-hand surface.

make an exception of eyesight and seeing. Many tedious laboratory researches in seeing indicate that the optimum brightness-level of a visual task for easiest prolonged seeing is above 100 foot-lamberts and there are indications that it may be 300 or 400 foot-lamberts. This means more than 100 foot-candles for reading black print on white paper and 1,000 and even 10,000 foot-candles for many other visual tasks. Of course, besides adequate light, it is necessary to give proper attention to other factors in lighting and seeing.

The relationships of light and sight reveal that the abilities and limitations of the visual sense depend upon light. For example, visual acuity as determined by black letters on a white background, does not reach a maximum until the test-chart is illuminated to a level much higher than 100 foot-candles. However, suppose we use a test-chart consisting of black letters on a very dark gray background. Then visual acuity does not reach a practical maximum until the level of illumination is higher than 1,000 foot-candles. The actual visualacuity of eyes at work is very important. This is also true of other visual functions. When eyes are tested with test-objects and test-charts fairly representative of the prolonged critical visual tasks that are being performed in the world of seeing one finds that eyesight is commonly grossly over-burdened. Furthermore, it requires hundreds and thousands of foot-candles to give millions of workers the comparable aid which light affords office workers who are supplied with 50 foot-candles. These are incontrovertible facts of measurement.

During the past score of years various researches have proved that seeing is an activity of the entire human being. They reveal that not only do eyes become fatigued but that seeing utilizes muscular, neural, and mental energy throughout the human see-

ing-machine. They verify the fact that the brightness-level of the visual task should be greater than 100 foot-lamberts for easiest seeing. Obviously, they verify the desirability of levels of illumination over an enormous range if light is to be specified for specific tasks. These researches indicate that the optimum brightness-level is of the order of those of common areas outdoors to which the eyes should be adapted.

Eyesight and Visibility

All things that are visible are not equally visible. To see objects quickly and accurately their visibilities must be far above the threshhold of barely seeing. This printed matter is at a certain visibility-level when the level of illumination is 10 foot-candles. It is at a higher visibility-level when illuminated by 100 foot-candles. Countless tasks of the work-world require hundreds and thousands of foot-candles if they are to have the same visibilities, respectively, as this printed matter has under 10 and 100 foot-candles. Certainly a person performing a visual task such as sewing with black thread on dark goods has a right to have the visibility of his task as high as that of the reader or the tasks of the office worker. Only lighting practice based upon the science of seeing can fit light to the task.

The science of seeing also shows how light can be fitted to the eysight as well as to the task. A simple example is 8-point type printed with black ink on white paper. A person with normal eyesight can read such printed matter under one-tenth of a foot-candle. No one would be satisfied with such an obviously inadequate level of illumination. Certainly 10 foot-candles provides a very moderate see-level or visibility-level for persons with average normal, or 20/20, vision. However, for a person with 20/40 vision about 40 foot-candles are necessary in order to bring the printed matter to the same visibility-level. About 100 foot-candles are necessary for a person with 20/80 vision.

Thus it is seen that when foot-candles are properly specified for each task and for the eyesight involved, the range of foot-candles becomes enormous. General illumination of 10, 20, 50, or 100 foot-candles must be supplemented with localized light is light and lighting are to be properly and adequately fitted to each specific seeing requirement. Until light is thus fitted to tasks and to eyesight, a great majority of workers performing prolonged critical seeing will continue to be unjustly and, in some cases, severely penalized.

Penalties of Poor Seeing

It should be obvious that adequate light and proper lighting are to eyes and to human seeing-machines what the electric motor is to human muscles and to human working-machines. In the age of electric power and machines we fit machines to the work and motors to the machines. Lighting practice can profit by this analogy.

The most obvious fact from the world of seeing is the increase in eyesight effectiveness with age, even among school children. Eye-defects are strikingly more prevalent among workers engaged in severe, prolonged, critical tasks of near-vision than among workers in occupations in which the eye-burdens are less severe. For example, a survey revealed that 78 percent of garment workers had eye-defects or eyestrain disorders. It requires neither courage nor imagination to predict that adequate light, fitted to the task and to the eyesight involved, would reduce the degree and prevalence of these eye-defects and eye-troubles. There is some evidence pointing toward such a result. More and more ophthalmologists are going on record to the effect that lighting is commonly inadequate and that eyesight suffers from this condition.

In an excellent paper in a leading ophthalmological journal it was stated as the result of an intensive investigation that 43 percent of the 126 pupils in the fifth grade of a public school reported, "ocular discomfort or inability to see clearly at all working distances. Approximately 70 percent of the complaints involved headaches, eye-aches, blurred vision, tearing and burning." These children were only about ten years old and one may assume from vast statistics that nearly all of them entered school with reasonably normal vision. Can anyone even risk the belief that if adequate light and proper lighting were available in school and at home, these appalling penalties would not have been reduced?

Incidentally text-books are printed in large type for young children, but they are also entitled to a similar factor of safety in lighting. The spread of the foot-candle requirements for even the tasks in the school-room will easily cover a range of 10 to 100 foot-candles to make the visibility of all the tasks approximately equal. A study of the lettering in most comic books reveals the need for hundreds of foot-candles in many cases if a reasonable visibility is to be attained.

Effects Measurable

The effects of adequate light and proper lighting upon production are measurable and appraisable in dollars. The effects upon eyesight and in reducing fatigue and waste of energy are measurable but not directly in dollars. However, they eventually affect production through health, tonus, fatigue and morale. To one familiar with the complexity of seeing there can be no other result from improved lighting than an increase in the efficiency, safety, and welfare of workers.

For years the lack of knowledge of the complexities and relationships of light, vision, and seeing could have been an alibi for the lighting industry. But that excuse no longer exists. In fact, the launching of the movement, Better Light Better Sight, a decade ago was a recognition of the opportunities and responsibilities revealed by the science of seeing. It is a source of satisfaction to have contributed to the structure of knowledge which. through light fitted to tasks and to eyes, is bound to conserve eyesight and other human resources and to read its beneficence throughout the highways and byways of human efficiency and welfare.

WHAT RELIGHTING MEANS TO AMERICA

HOWARD M. SHARP, *President Illuminating Engineering Society*

IT MAY SEEM a little strange, even grandiose to talk about relighting America, as though the lighting we see around us was ancient and inadequate. Actually upon sober reflection that is exactly the situation. The advancement in applied lighting and the means by which it is accomplished has moved much faster and farther than the appreciation of those who are its recipients.

So in a very real sense of lighting up to the advent of Better Light Better Sight ten years ago was in the kindergarten stage. It should be replaced, and will be replaced as the consuming public grows in understanding of its value and learns that its benefits are not restricted to the fortunate few.

Lighting, as the indispensable partner of mankind's most vital sense, vision, has many assets and is so involved in human activities that it is extremely difficult to separate the influence of light and present it in clear cut delineation.

Lighting for Industry

Let us discuss the lighting of industry as an example. The end result of our industrial plant is production of useful goods and services.

I have walked over many thousands of square feet of industrial plant devoted to producing the materials of war. I know the product could not have been turned out with the speed and precision recorded, under conditions of lighting common during the last war. In those days 5 foot candles was a lot of light but today 20, 30,

Industrial toll since Pearl Harbor that could have been prevented by modern lighting—Killed, 1,880; permanently disabled, 100,000; injured, 225,000

50 foot candles have proven their worth. Exactly how much lighting contributed in percentage of production, quality of products, etc., no one can say. Frankly, human beings are too complex for that sort of simple statement. But chief draftsmen will tell of the increased output of their department after the installation of adequate lighting. Clerical departments that were accustomed to working overtime at peak periods find all work out on schedule under adequate lighting. Inspection bottlenecks disappear when the men can see. These are but a sample of the almost countless experiences that attest to the influence of lighting on production. They are not mysterious. They simply bear on the fact that by removing negative factors the human is allowed to reach his or her optimum of skill and output of nervous and muscular energy in constructive channels.

Another important relationship has to do with safety. Safety is a very complex subject and exact percentages are difficult. However, by deduction alone anyone can reason that to operate an industrial plant in the dark would result in more accidents than under daylight, everything else being the same. Events which move faster than the speed of vision cannot be influenced by light, but within the practical range of lighting levels it is possible to reduce light-caused accidents to one-fourth their previous total. Of all accidents it is believed that 20 percent are light-caused either direct or contributory. Since Pearl Harbor industrial accidents have killeed 37,000, permanently disabled 210,000 and injured 4,500,000. By applying the above percentages, lighting that is attainable now would have saved 1,880 lives and 100,000 permanent disabilities, plus 225,000 less severe accidents. We gasp at war casualties but continue blithely to roll up totals almost as great while means of prevention are easily at hand.

Eighty percent of our education comes by way of the eye—At an average of 5 percent of the total educational cost per pupil adequate lighting can be provided

Lighting Aids Vision

The occupants of classrooms and offices are confronted with the most severe and unnatural of eye tasks. The eyes are constructed for minimum effort at distant seeing, that is over 20 feet, and under these conditions can carry out their function without calling upon more energy than can be readily replaced. But the task of reading, carried on at close distance, over long periods of time and involving discrimination of fine detail is beyond the power of the average eye to cope with without strain. If deterioration of visual function is to be held at a minimum, every aid to seeing must be provided. Lighting is the most flexible assistance. Here again it is realized by everyone that without light the eye cannot function, but the compromise seems always to be at those levels and quality that do not give immediate discomfort. The result is that today the average level of illumination is around 12 foot-candles, whereas 30 to 50 foot-candles is known to be desirable and attainable. No matter how unfavorable any given eye task is, lighting can improve it. Then too, not only can lighting affect the given task, but by proper distribution of brightness, the entire environment can be made favorable so that eye comfort and relief from excessive strain can be had.

Over 80 percent of our education comes by way of

the eye. There is much sound evidence which shows the effect of adequate lighting upon achievement and health. At an average of 5 percent of the total educational cost per pupil, adequate lighting can be provided. Common sense indicates this as a modest outlay for the very vehicle that makes education possible.

In offices, lighting in accordance with the best practices will cost about 5 percent of the payroll, and will return more than this is more productive use of space, greater output, and fewer absentees.

Light for Selling

Present lighting of commercial establishments is on the average of a low order, measuring around 10 foot-

Ninety percent of the fixtures in the homes of America need replacing because of deficiencies in design, light delivered and lighting quality

candles and utilizing lighting equipment that is more prominent and eye attracting than the merchandise. A point almost entirely overlooked is that the majority of shopping is done in the daytime with people walking in from the street where the eyes have become adapted to the hundreds of daylight footcandles. In the relatively gloomy interior a person can walk 60 feet before he really begins to see clearly what is about him. It is almost a cliché to say that what can't be seen won't be purchased. Therefore, amounts of light from 30 footcandles upward for the general selling area should and can be the standard, with higher levels for local displays.

The lighting of show windows has progressed farther than other commercial uses of light. In the post victory period it will be possible for the modest store to build attraction and punch into the window lighting at moderate cost, by means of high general brightness and localized attention getters through strong accents or color.

There is growing appreciation of the value of appealing to shoppers through the use of light, color, scientific display, and floor layout, which follow the natural gateway of the senses. There can be no place really, for the store which adheres to the pattern of the cracker barrel age. Distribution of goods and services must keep pace with capacity for production, for it is the bridge to the ultimate consumer, and lighting can do a major share of the job.

Light for Living

In general the lighting of homes is accomplished by means of fixed equipment, called "fixtures," and mobile equipment known as "portables." Each has an important function, although the emphasis will vary depending upon individual tastes. It can be safely assumed that 90 percent of the fixtures need replacing because of deficiencies in design, light delivered, and lighting quality. This is particularly true in dining rooms, kitchens, laundries, and work shops. With portable equipment the situation is somewhat improved because of the emphasis during the past 10 years on lamps of good lighting quality and pleasing design. There is one other aspect of adequate home lighting and that is safety. Contrary to popular opinion the bathtub is not the prime source of accidents; falls on stairways and steps are the No. 1 source. Proper lighting for these areas costs almost nothing so it seems ironic that so much suffering and expense should stem from such shortsightedness.

Light for Traffic Safety

The major objective of lighting for streets and highways is to facilitate the safe movement of traffic, both vehicular and pedestrian. When this purpose is served other benefits automatically accrue, such as civic betterment, protection against assault, stimulation of business, and increased capacity of existing roadways.

The part that light plays in this record has been substantiated in every conceivable circumstance, the latest being the experiences in dimout areas. It is possible without recourse to extreme measures to bring the night accident rate down to the day accident expectation, but on the average, night fatalities can be cut in half by means of modern high visibility lighting systems. It is not necessary to consider all streets and highways, because about 10 percent of total mileage accounts for 50 percent of the night fatalities.

In the face of the evidence that is available it is difficult to understand why there should be any reluctance on the part of public authorities, the traffic and safety engineers to apply the remedy of adequate lighting to the mounting ills of motor vehicle traffic. As one police officer told me recently; "If the families of all those killed and injured could be brought together in one place, there could be only one answer to the problems of traffic safety—proven measures of correction would be applied—and fast."

In conclusion I would like to emphasize that the Illuminating Engineering Society is continually con-

The average level of illumination in offices is around 12 foot-candles, whereas 30 to 50 foot-candles is known to be desirable and attainable—The cost of lighting in accordance with the best practices is about 5 percent of the payroll

ducting investigations and research in lighting applications, and making these studies available to the industry and the public. Lighting for the areas in which people work, live and play is not a matter of guesswork, but based upon many years of accumulated study and experience. No one need be without the benefits of such findings, because they are available in understandable form.

Thus the relighting of America can proceed on an orderly basis of science and engineering if it is sparked by intelligent commercial enterprise and a conviction that light pays great human dividends.

WHAT RELIGHTING MEANS TO PUBLIC SAFETY

WILLIAM M. GREENE, *Director Connecticut Highway Safety Commission*

NOW WITH THE National Inter-regional Highway Committee's report asking for the construction of 33,920 miles of highways before the Congress, the 48 state highway departments lined up behind the American Association of State Highway Officials program, and city planning commissions busy, plans for new street and road design in many cases are already out of the construction and design rooms of more than 587 cities to be affected.

With the post-war era will come flight strips and clover leaves, emphasized traffic control and more attention to accident experience. Limited access and express highways, underpasses and the transition from highways to streets in suburban areas have centered the attention of officials on both proper street and highway lighting and their relationship to each other.

What will the next ten years bring us?

If American cities would start planning now they could at the termination of the war have definite plans and policies whereby much worth while employment would be created in manufacturing, installing and maintaining adequate street and highway lighting.

A conservative estimate indicates that some five hundred million dollars worth of modern street and highway lighting would be necessary bringing an additional revenue to the utilities around fifty million annually.

The real saving in such a program, however, would consist in the reduction in the cost of night accidents and this item alone would more than pay for the capital investment and the annual maintenance and operation cost.

Pays for Itself

Richard E. Simpson, consulting engineer for the State of Connecticut, recently made this succinct statement, based on dimout conditions: "A community pays for good highway lighting whether it actually has it or not."

In 1941 there were 7,500 fatal accidents, on 30,000 miles of main traffic streets, of which 5,000 occurred at night. If these sections had been properly lighted 60 percent of all fatalities would probably have been averted. Adequate lighting would have saved 3,000 from death, 100,000 from injury, 450,000 cases of property damage and $200,000,000 losses.

In the eight years from 1930 through 1938 rural pedestrian fatalities increased 43 percent, while rural non-pedestrian fatalities increased 8 percent. Rural Ohio is probably as typical of the average state. According to Chief Traffic Engineer Harry Neal of Ohio, one-half of all rural pedestrian accidents for 1942 occurred between 6 p.m. and midnight and 75 percent between 6 p.m. and 6 a.m.

The Price of Inadequate and Out-of-Date Street and Highway Lighting

6,000 Lives
200,000 Injuries
900,000 Cases of property damage
$400,000,000 Economic losses

A survey of the New Jersey highway lighting program, in which the state gives aid to the counties, revealed that in 16 counties where modern safety lighting had been installed the fatalities for one year were reduced from 245 before lighting to 154 after adequate lighting.

The lighting of dangerous traffic intersections is a worth while safety measure. In Los Angeles after 25 traffic intersections were lighted, for an equal period before and after relighting, night accidents were reduced 78 percent and night personal injuries 79 percent and night fatalities 92 percent. (Deaths were reduced in the ratio of 12 to 1.)

In the United States today there are 500,000 miles of designated highways. Certainly not more than 4 percent of these, or 20,000 miles, urgently need lighting. These are certain dangerous stretches of straight highways going through towns and villages, approaches to big cities, underpasses, bridges, clover leaves and other intersections, traffic circles and grade crossings, all of which require special study and treatment.

In line with studies made in New Jersey, if the dangerous 20,000 miles of highways were lighted adequately, the saving would be approximately the same as in city lighting—3,000 lives, 100,000 injuries, 450,000 cases of property damage and $200,000,000 in economic losses.

Thus the adequate relighting of streets and the lighting of the dangerous highways combined would double these savings.

Now comes the all important question, "Who is going to finance street and highway lighting?"

There is in reality no need for an added impost on gasoline—it is already too heavily taxed. Total collections of gas taxes and registration fees by states amounted to $1,452,011,000 in 1941, of which $215,000,000 was diverted for non-highway purposes.

Ten percent of the diverted funds would pay for maintenance and operation of the 20,000 miles of highway lighting.

In addition to the highways the next ten years should see 22,000 miles of city thoroughfare relighted at a few cents additional cost per capita and a saving of at least ten cents per capita in fewer night accidents.

GETTING STARTED

The number and character of activities affecting post-war lighting that are now being worked on or planned by the several nationally organized groups in the lighting industry indicate that relighting of America will get off to a good start. The programs which are far enough along to mention are grouped as follows under eleven headings to indicate the scope of the planning:

1—Education

A course of 12 lessons in the fundamentals of practical lighting has been prepared by the I.E.S. Lighting Education Committee. Other more advanced courses are in preparation. These courses will be in outline form for use by local groups.

Preparation of a Handbook on Illumination is under way by the Illuminating Engineering Society.

A school educational program is being developed by the Residential Lighting Committee of the National Better Light Better Sight Bureau involving the preparation of a text book and a series of supplemental charts covering the relation of proper lighting to comfort, health and efficiency of school children. This will be a classroom study project. The plans also include sound slide films and possibly a motion picture.

2—Research

A Research Fund, with its own trustees is now being created by the Illuminating Engineering Society to promote research in lighting and related subjects.

3—Standards and Technical Data

Basic standards for quantity and quality of illumination are being prepared by a special I.E.S. committee. From the investigations of this committee are expected to come practical methods for calculating brightnesses.

Additional special I.E.S. reports containing recommended practices for specific seeing tasks are in process and revisions will be made in certain of the recommendations to bring them up to current values.

4—Certification

I.E.S. committees are preparing luminaire performance recommendations covering illumination. These will be the basis for standards to be prepared by trade groups.

The National Better Light Better Sight Bureau committees are planning to establish luminaire specifications embodying I.E.S. recommendations which can be used as a basis for certification.

The A.L.E.A. specification certification program for residential fixtures will be renewed.

5—Motion Pictures

An industrial lighting film is now in production under Illuminating Engineering Society sponsorship.

An animated picture is being projected by the Commercial and Industrial Lighting Committee of the National Better Light Better Sight Bureau.

6—Marketing Manual

Under the sponsorship of the Industrial and Commercial Lighting Equipment Section of N.E.M.A. a Manual for Industrial and Commercial Lighting is being prepared for distribution to utilities, wholesalers and electrical leagues.

The Lighting Sales Committee, E.E.I., is preparing a report on post-war lighting markets including discussion of sales plans and certified equipments.

7—Advertising and Promotional Material

The Street Lighting Section of N.E.M.A. is embarking on a program of advertising in magazines going to consumers, utilities and municipal officials. This will be supplemented by direct mail pieces, news letters and publicity releases.

The Industrial and Commercial Lighting Section of N.E.M.A. has prepared direct mail pieces which are now available to utilities at cost.

Newspaper mats to arouse consumer interest are planned by the Commercial and Industrial Lighting Committee of the National Better Light Better Sight Bureau.

8—Exposition

The International Lighting Exposition will be held from April 19 to 23, 1945, in Chicago, under the auspices of the Industrial and Commercial Lighting Equipment Section of N.E.M.A.

9—Services

Plans are being made by the Residential Lighting Committee of the National Better Light Better Sight Bureau to develop layouts, suggestions, and ideas for making better use of residential lighting equipment to aid post-war home builders.

A Lighting Layout Guide is being prepared by the Industrial and Commercial Lighting Section of NEMA to include foot-candle levels and suitable fixture types for each industrial operation.

10—Lighting Institutes

The National Better Light Better Sight Bureau is studying ways of expanding the number of local lighting institutes.

11—Sales Training

A special sub-committee of the E.E.I. General Commercial Committee is working on a sales training program covering the fundamentals of all electrical applications including lighting.

To help you RELIGHT THE SCHOOLS OF AMERICA

More than 200,000 schools in this country, according to one authority, need complete re-lighting.

So, by all means include school lighting specialists when you set up your lighting division.

This field has great promise for load-building possibilities in the postwar period . . . not only because the need is there, but because most school authorities are already sold on better lighting.

Consider these facts from a survey conducted by NATION'S SCHOOLS:

1. **83% want 15 footcandles** or over in classrooms. Almost 20% want over 25 footcandles.
2. **Almost three-fourths** think it desirable to have electric-eye control of lighting.
3. **Out of 300 replies,** 213 want fluorescent; 154 want incandescent lighting equipment. This indicates an interest in combined types of lighting in some cases.
4. **Of the 154 voting** incandescent, 80% prefer a plastic semi-indirect to an enclosing globe.
5. **40% want germicidal lamps** in either locker rooms, toilet rooms, infirmaries or clinics.

This is what school officials are thinking about in the way of postwar re-lighting. You'll want to make sure that *your* lighting department has school lighting specialists able to answer their questions and to specify equipment which will do the job they want.

Sincerely,

A. F. Wakefield

The Commodore

Do you have our helpful booklet in your postwar planning files? "Recommendations for Classroom Lighting" deals with—

1. Influence of Lighting on Scholarship —Student—Teacher Attitudes, Based on Test Data Compiled by Several School Departments.
2. American Recommended Standards for School Lighting.
3. Lighting the New School.
4. Room-by-Room Re-lighting.
5. Case Histories—Results From School Re-lighting Programs.
6. Fluorescent—Incandescent Lighting for Schools.

From time to time, the F. W. Wakefield Brass Company releases new test data on school lighting as compiled in cooperation with educational authorities. If you would like to receive this material as issued, drop us a line. We would be glad to put your name on our school lighting list.

THE F. W. **Wakefield** BRASS COMPANY

RED ● SPOT LIGHTING FOR WAR PRODUCTION . . . FOR PEACETIME FUTURE

VERMILION, OHIO

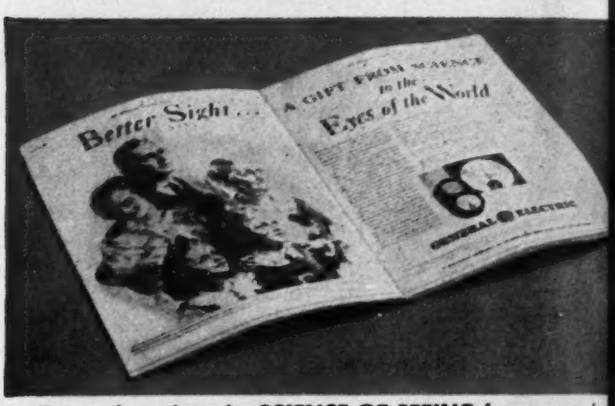
TEN YEARS OF G-E PARTICIPATION IN BETTER LIGHT BETTER SIGHT

Remember the picture at the left? Ten years ago it peared in the Saturday Evening Post, in General Electr first advertisement on the Science of Seeing. It mar the start of ten years of active and wholehearted participation in Better Light—Better Sight.

We've always liked that picture, because we think expressed in a warm, human way the vision of he and happiness that Better Light—Better Sight co bring to the people the lighting industry serves.

When the Edison Electric Institute first conceived idea of Better Light—Better Sight in Chicago in 19 few of us would have dared predict the success it has achieved. We think the lighting industry has a ri to be proud of its accomplishment during the past dec in bringing the benefits of Better Light—Better Si within the reach of all.

In the next ten years, Better Light—Better Sight is tined to inspire an even broader concept of better livi A few of our past contributions are shown on th pages. We hope General Electric will be privileged make many more. The first of them is underway n We've built it around an idea that already has proved appeal . . . *Moving the Sun.* The following pages tell you more about it.



Remember when the **SCIENCE OF SEEING** became an im portant part of consumer education toward Better Ligh —Better Sight?

Remember **G-E's HOME LIGHTING KITS?** Skirts are highe now...so are levels of lighting. The G-E lighting kit helped

G-E MAZDA LAMPS

member the expanded **G-E TRAINING PROGRAMS** t grew along with and helped promote the development Better Light—Better Sight?

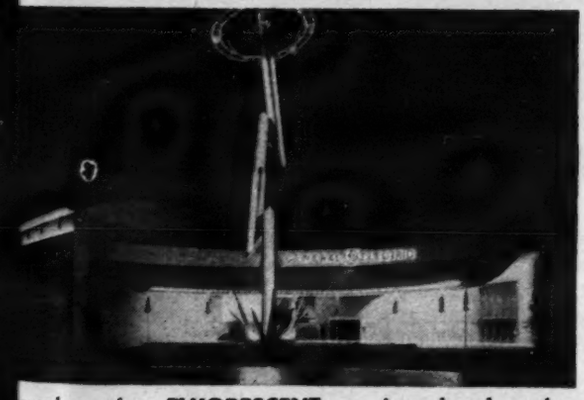
Remember how **G-E's LIGHT CONDITIONING** promotions helped educate the public to an appreciation of Better Light—Better Sight?

member the **UTILITY BLUE BOX** that came along each r with complete plans for developing your lighting rkets?

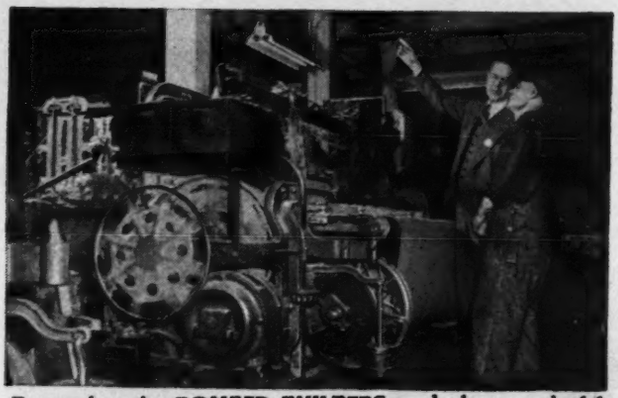
Remember how **BULB SNATCHING** became a household word and filled those empty sockets? (Sure, Henry Bulb-snatcher will be back).

member what a boost it was when the **G-E HOUR OF ARM** went on the air for better lighting?

Remember when **FORTY-NINE** seemed like a lot of foot-candles? Not any more, but we'll have similar promotional activities.



member when **FLUORESCENT** was introduced at the World Fairs? There'll be more new lamps after the war.



Remember the **BOMBER BUILDERS** and the wonderful job they did in raising lighting levels for war production?

GENERAL ELECTRIC

LOOKING TO THE FUTURE WITH "MOVING THE SUN"

Ideas that capture the public's imagination are few and
between. The public's enthusiastic reception of "Movi
the Sun" indicates it is such an idea . . . one that will h
develop the central theme of Better Light—Better Sight
our postwar plans.

Take a look at your customers in their postwar living roo
But instead of moving their living room outdoors we

G-E MAZDA LAMP

ing outdoor living to them indoors, into their homes, ores, offices and factories.

hat's what the people we serve really want! They said so th a record-breaking readership of the recent General ectric advertisement in which the above photograph ap- ared. They said so in an independent nation-wide survey at followed publication of the ad. And they said they were willing to spend the money to get these benefits.

From the lighting industry itself have come many comments that demonstrate the industry's awareness of the broad opportunities summed up in "Moving the Sun." The lighting industry has the knowledge and the tools, the ability and the techniques to give its customers what they want . . . and what they want is nothing less than the benefits of outdoor living indoors.

GENERAL ELECTRIC

MILLIONS WILL ENJOY THESE *NEW BENEFITS*

What part of the sun do your customers want? Better light, of course, is foremost . . . higher levels for better sight and greater variety for added attraction . . . ultraviolet radiation for a daily sunbath and short ultraviolet that kills harmful bacteria . . . gentle, soothing infrared heat for the relief of aches and pains.

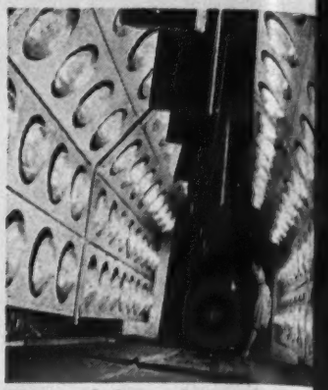
The lighting industry already has the knowledge needed to bring to its customers the benefits of sunlight illustrated on these pages. There is nothing startling about them . . . until we think of them in terms of postwar market development, and then the possibilities seem stupendous.

We are confident the lighting industry will be among the leaders in establishing the high levels of production and employment to which we all aspire.

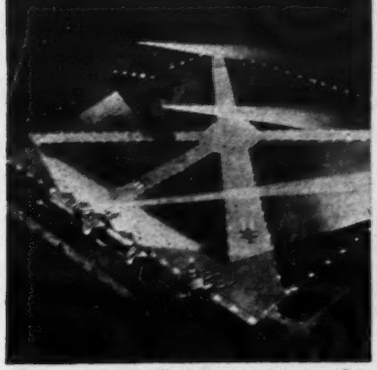
Experts forecast an annual market of over 4,500,000 germicidal lamps, used to destroy harmful bacteria.

Indoor "sunlight" will create be and more healthful living everywh —thanks to millions of G-E Sun La

Safer, better and faster night driving will be achieved by relighting almost 2,700,000 obsolete street luminaires.



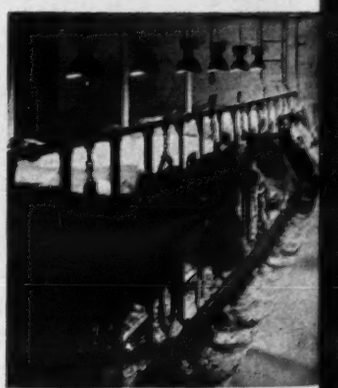
New and faster drying installati will develop a $5,000,000 market G-E Drying lamps and equipment



Better airport lighting means safer night flying, more dependable operation for over 6,500 postwar airports.

Brilliant illuminated signs and plays will give advertisers a po selling force to attract more custom

Striking highlights will accent goods for sale in smart shops, now 90% in need of modernized lighting.



Farms everywhere will have ad "daylight"—a far-reaching effect new G-E lamps for farm installati

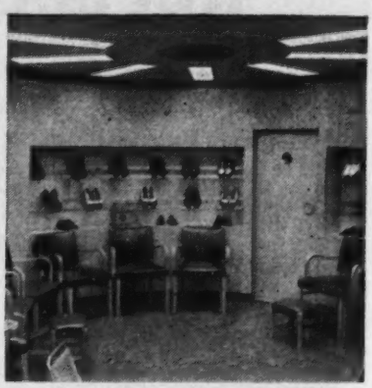
KEEP BUYING WAR BONDS

GENERAL

lorful ultraviolet light promises ny new and striking decorative ects in stores, homes and theaters.

Over 750,000 new homes built yearly will provide millions of new sockets for incandescent and fluorescent lighting.

thoritative surveys show that a pent- demand for 100,000,000 Christmas e lamps will exist after the war.



Dramatic lighting with G-E Fluorescent lamps will create a buying atmosphere in 1,500,000 stores that need relighting.

, glare-free indirect lighting from Silver Bowl lamps will modernize y home lighting installations.

Daily heat baths in postwar homes will be provided by soothing heat from General Electric Heat lamps.

ter, easier seeing for nighttime ts events will be made possible by floodlighting lamps.

"TO MAKE G-E LAMPS STAY BRIGHTER LONGER"
The Constant Aim of G-E LAMP RESEARCH

Hear the General Electric radio programs: "The G-E All-Girl Orchestra", Sunday 10 p. m. EWT, NBC; "The World Today" news, every weekday 6:45 p. m. EWT, CBS.

EP THE WAR BONDS YOU BUY

HOW G-E WILL HELP BRING THESE NEW BENEFITS TO YOUR CUSTOMERS

1. **National Advertising** in scores of magazines will register more than 500,000,000 consumer impressions annually.
2. **Full 125-station NBC Network** will feature the G-E All-Girl Orchestra —the only national radio program devoted exclusively to lamps and lighting.
3. **Tested Displays and Sales Aids** will provide dealers with a complete point-of-sale selling service.
4. **New Standards of Lighting** will be established by projects such as G-E's architectural design program.
5. **Versatile G-E Training Program** will help train skilled personnel for every field of lighting service.
6. **G-E Leadership in Research** will help provide tools for "Moving the Sun".

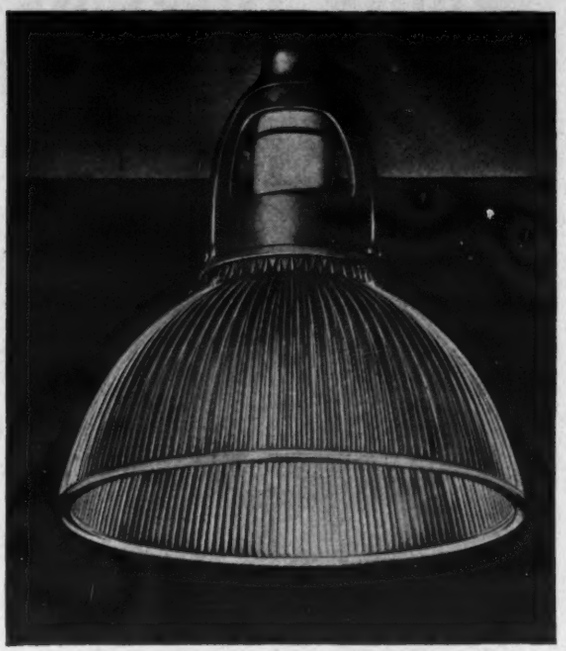
ELECTRIC LAMPS

HOLOPHANE presents

SUPERFICIENCY

*"One-point-five"

REFLECTORS

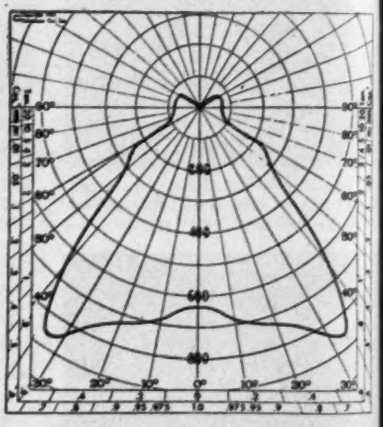


Conduit (½") Mounting Type

Outlet box cover Mounting Type

Prismatic Reflector

***Product of Holophane Research,* SUPERFICIENCY REFLECTORS** are the advanced answer to the growing need for modestly priced small glass units for general industrial and utility areas. These reflectors are altogether new in optical design. They express the traditional Holophane principles of high lighting efficiency, easy installation and maintenance. Their adaptability to standard size fitters and their wide range of wattage—25 to 300 watts—make them practical and economical for general service. Application, performance and price data available on request.



- *PRISMATIC GLASS for maintained efficiency*
- *PRACTICAL for replacements on existing jobs*
- *ECONOMICAL INSTALLATION and MAINTENANCE*

★ ***"One-point-five" Reflectors** are designed to provide efficient, even illumination on spacings as great as 1.5 TIMES the mounting height above working plane.*

HOLOPHANE COMPANY, INC..... *Lighting Authorities Since 1898*

342 MADISON AVENUE, NEW YORK 17 • Holophane Co., Ltd., 385 Yonge St., Toronto, Can.

The Curtis SKYLUX

featuring...

SCIENTIFIC SHIELDING AND HIGH LIGHT OUTPUT

for two 40-watt Fluorescent Lamps

A revision of the priorities regulations permit us to again offer the famous Curtis SkyLux, with steel reflectors, baked snow-white Fluracite reflecting surfaces and Satin Gray enameled shields and molding.

The high efficiency of this unit, combined with scientific shielding, has made it the outstanding two-lamp fixture on the market. The SkyLux shield prevents a direct view of the lamp from ordinary angles and at the same time the inner surface of Fluracite serves as a reflector to direct the light downward. This is accomplished without trapping light and no horizontal surfaces are present to collect dust.

The SkyLux principle results in high initial light output which is maintained with little depreciation throughout the long life of the fixture.

CURTIS *Lighting*, INC.

6135 WEST 65TH STREET, CHICAGO 38, ILLINOIS

"Why I sell

"No investigation has been made by Fleur-O-Lier Manufacturers regarding the patent situation on these design or construction suggestions."

Hot Spot! Because a FLEUR-O-LIER fixture must stand a high voltage kick at starting, fixture is tested at 2000 volts for one minute to make sure it can "take it". *Electrical safety for you.*

Obstacle race! Certified starters are put through an endurance test of 20 hours under the most unfavorable conditions. It means assurance that the certified starter you get will stand up

Fleur-o-liers"

Certified
FLEUR-O-LIER
The Manufacturer guarantees by affixing this label that this Fluorescent Luminaire is a duplicate of samples found by periodic examination to comply with the minimum requirements as set up in the
"SPECIFICATIONS FOR LUMINAIRES, FITTINGS AND AUXILIARIES FOR FLUORESCENT LAMPS"
Electrical Testing Laboratories, Inc.
NEW YORK, N. Y. 4-42
E·T·L
A COPY OF THIS CERTIFICATE SHOULD APPEAR UPON EACH UNIT OR PACKAGE
E·T·L
FLUORESCENT LIGHTING FIXTURES EMPLOYING EXISTING TYPES OF LAMPS ARE NOT RECOMMENDED FOR SCHOOLS, OFFICES AND SIMILAR LOCATIONS UNLESS LAMPS ARE SHIELDED FROM DIRECT VIEW
THIS CERTIFICATION IS CONTINGENT UPON EMPLOYMENT OF CERTIFIED AUXILIARIES OF OVER 85% POWER FACTOR

This label on a fluorescent lighting fixture means electrical, mechanical and lighting excellence. Insist on it when you buy or specify.

When I have a fluorescent lighting job, I can always depend on FLEUR-O-LIERS to deliver the goods. Look at the reasons:

"First, FLEUR-O-LIER is not a brand of fixture, but a *service* that protects us all. Over 35 leading fixture manufacturers share in it. I can pick the lines I want to sell, from a wide variety of sizes and designs . . . and *know* that they're *all* dependable. Second, every part of a fixture labeled FLEUR-O-LIER—ballasts and starters—the whole works, is *tested* and *certified.*

"Tested and certified to what? Why, to definite standards, set up by lighting experts. Electrical Testing Laboratories, Inc. of New York does impartial testing and certifying to assure me and my customers of constant protection and dependability."

GET THIS BOOKLET!

"50 Standards of Satisfaction"—tells the story of the FLEUR-O-LIER Manufacturers' program and shows tests. Write FLEUR-O-LIER Manufacturers, 2126-7 Keith Building, Cleveland 15, Ohio.

THE STORY'S ON THE LABEL. LOOK FOR IT WHEN YOU BUY.

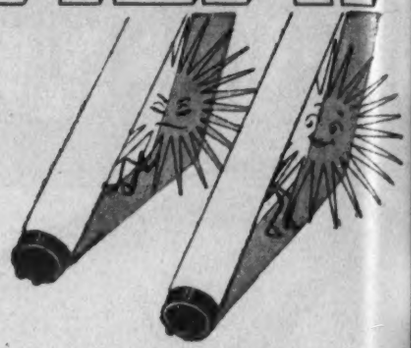
FLEUR·O·LIERS

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

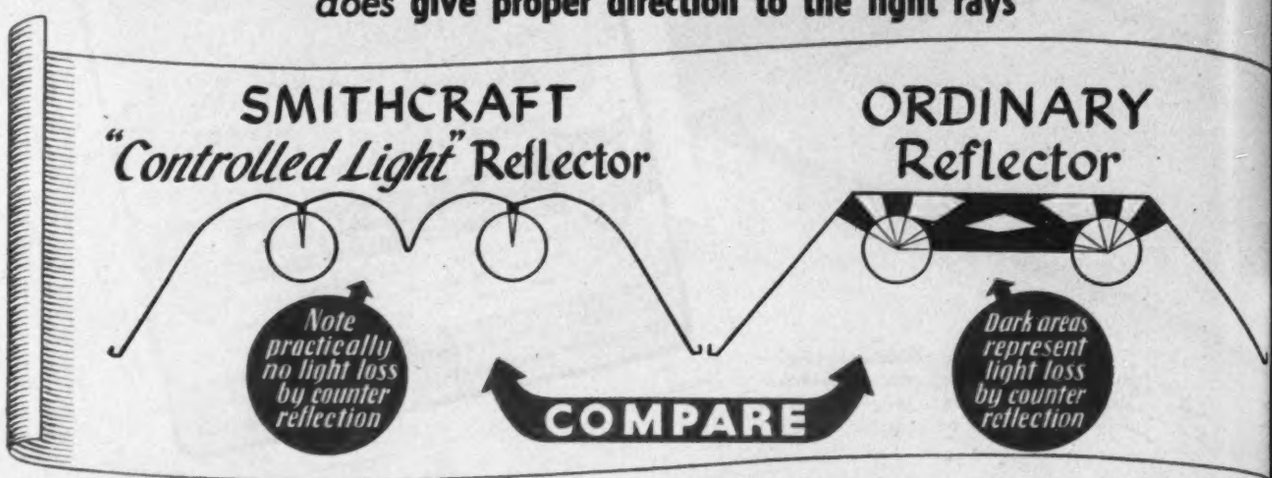
Light rays can CHEAT

unless they are brought out of hiding and properly directed



The NEW SMITHCRAFT "*Controlled Light*" Reflecto

does give proper direction to the light rays



This entirely new scientifically engineered V-Reflector provides the utmost in lighting efficie and output. Light loss is reduced to a minimum. Controlled light reflector dir maximum light to the working plane—actual foot candle tests prov greater effectiveness.

Send for full details of this outstanding fixture deve ment—and your next installation wi Smithcraft.

This new conception in lighting by Smithcraft will give you the utmost in customer satisfaction. Mechanical excellence all-steel for strength—wide variety of mounting methods—new captive-turn positive reflector fastener or release—Supercoat finish, baked or porcelain enamel—simple installation and easy maintenance—all these and more available with the new Smithcraft Industrial Fluorescent line. No wonder the Swing to Smithcraft is nation-wide!

A COMPLETE FLUORESCENT LINE

Industrial units for individual and continuous row mounting. Also smartly styled commercial units.

All 2-40 and 2-100 industrial and commercial fixtures are available with LIGHTNING START.

A. L. SMITH IRON CO., Chelsea 50, Mass.

FOR DEPENDABLE LIGHTING SERVICE

DURO TEST 2,000 HOUR INCANDESCENT LAMPS are sturdily designed and ruggedly constructed to withstand the severe operating conditions encountered in industrial lighting, and to give much longer service than is to be obtained from ordinary "general service" lamps. They are fully backed by the Duro Test one year free replacement guarantee.

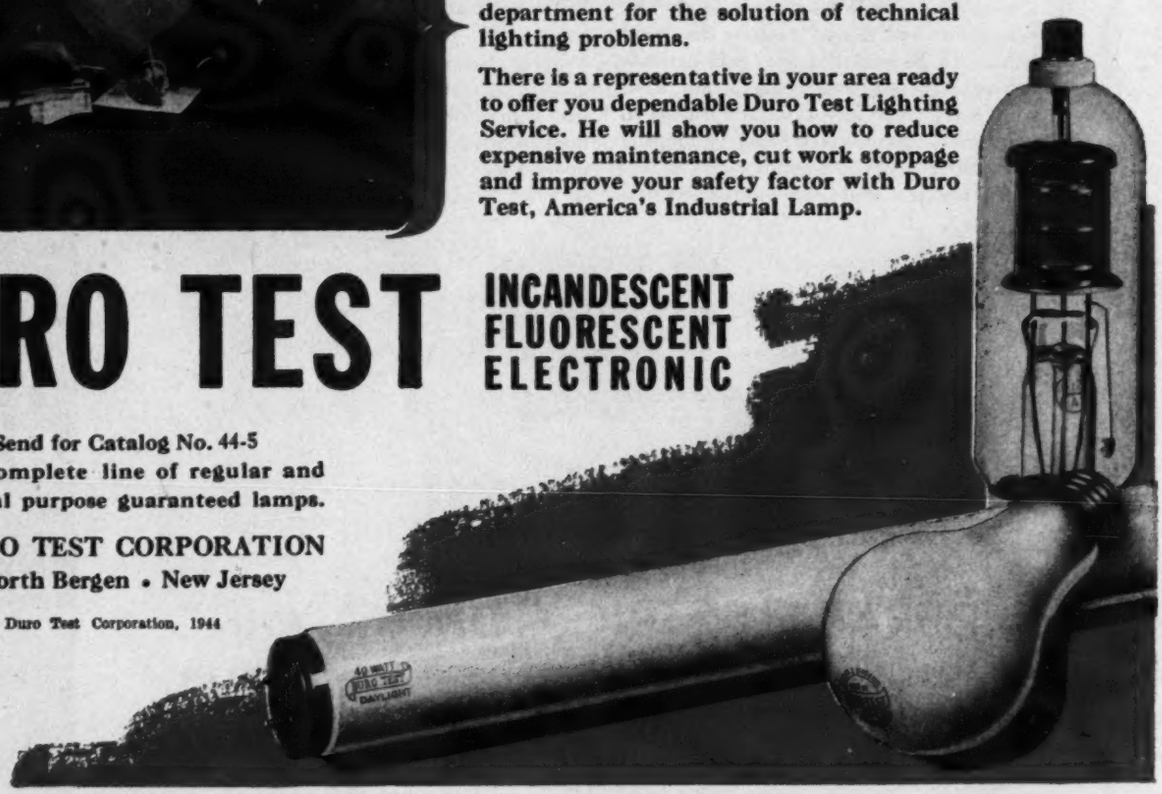
DURO TEST FLUORESCENT LAMPS, too, are distinguished products of precision engineering and high manufacturing standards. They are warranted for an entire year—your assurance of long, dependable service.

BY CALLING REGULARLY, our trained representatives become acquainted with your lighting layouts and lamp requirements. They recommend the proper lamp for the proper service and offer, without obligation to you, the services of our engineering department for the solution of technical lighting problems.

There is a representative in your area ready to offer you dependable Duro Test Lighting Service. He will show you how to reduce expensive maintenance, cut work stoppage and improve your safety factor with Duro Test, America's Industrial Lamp.

DURO TEST

INCANDESCENT
FLUORESCENT
ELECTRONIC



Send for Catalog No. 44-5
for complete line of regular and special purpose guaranteed lamps.

DURO TEST CORPORATION
North Bergen • New Jersey

Copyright by Duro Test Corporation, 1944

For most industrial, commercial and decorative lighting,

Fluorescent is Better

HERE'S THE DIFFERENCE!

There are two kinds of fluorescent lighting—*hot cathode*, the older type, and *cold cathode*, the newer type, of which Zeon fluorescent lighting is the outstanding example. Both types are good; both are a great improvement over incandescent light in most cases. But the newer cold cathode fluorescent has many advantages over the hot cathode type—advantages which in some installations are of supreme importance. Here is a quick comparison of the two types:

HOT CATHODE	COLD CATHODE
Highest efficiency; average output 42 lumens per watt. (Comparable incandescent lamp around 15 lumens per watt).	Practically as high efficiency; average output 39 lumens per watt. (Elect. Test Lab. as quoted by Architectural Forum).
Lamp life two to three times as long as incandescent lamps.	Lamp life extremely long. Less maintenance.
Multiple auxiliaries: starter; reactor; wiring to each lamp.	One auxiliary—a transformer. Series circuit. In special installations up to 100 feet of tube from one outlet.
Fixed lengths, standard size lamps.	Standard size units, or varying lengths of tubing for custom-built installations.
Inflexible, straight units. One fixed light output.	Completely flexible; any length, any shape. Light intensity variable through current control. Almost unlimited range of colors.

FEDERAL ELECTRIC KNOWS COLD CATHODE

Federal Electric Company, Inc., has been a leader for over fifteen years in the development and use of gaseous discharge lamps. To Federal Electric, cold cathode manufacture and operation is not new; what *is* relatively new is its adaptation to industrial, commercial, and residential illumination. This has made great strides in the last few years, because of the simplicity, efficiency, long life and practically no maintenance of cold cathode lighting.

Federal Electric Company will gladly assist you with suggestions for designing, installing, or operating cold cathode fluorescent lighting systems. Call the nearest Federal Electric Company office, or write direct.

FEDERAL ELECTRIC ZEON COLD CATHODE FLUORESCENT LIGHTING

LIGHTING DIVISION

FEDERAL ELECTRIC COMPANY, INC.

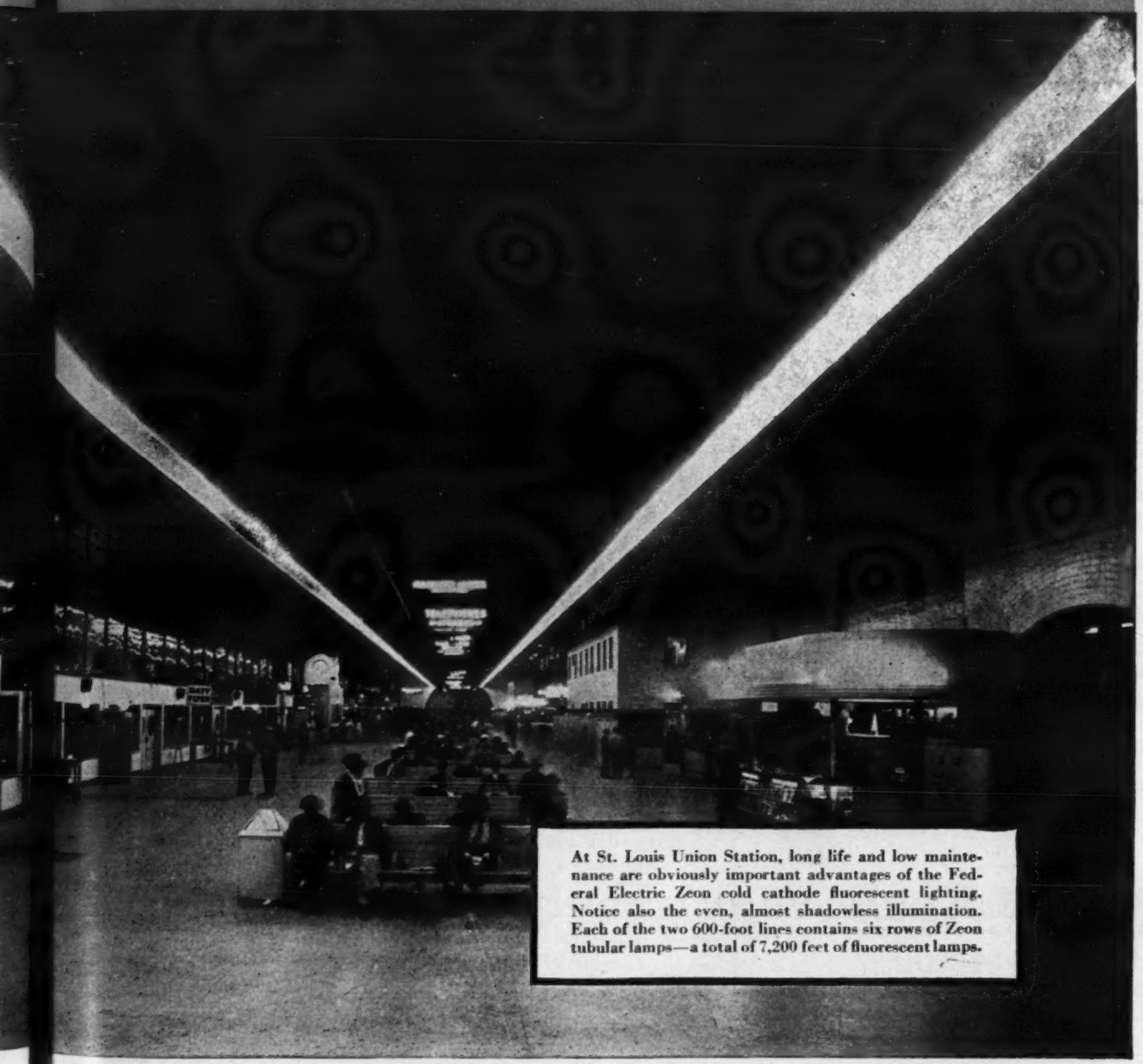
8700 SOUTH STATE STREET, CHICAGO 19, ILLINOIS • TELEPHONE VINCENNES 5300

Branch Offices: Cincinnati • Houston • Louisville • New Orleans • Dallas • Indianapolis
Milwaukee • New York • Duluth • Kansas City, • Minneapolis
Philadelphia • *Subsidiary Company:* Federal Brilliant Company, St. Louis, Missouri

there are 2 Kinds of Fluorescent Lighting...For most applications

Cold Cathode is Best

★ LONGER LAMP LIFE
★ LOWER MAINTENANCE COST
★ INSTANT STARTING
★ CONSTANT LIGHT FLOW
★ FEWER AUXILIARIES
★ GREATER FLEXIBILITY



At St. Louis Union Station, long life and low maintenance are obviously important advantages of the Federal Electric Zeon cold cathode fluorescent lighting. Notice also the even, almost shadowless illumination. Each of the two 600-foot lines contains six rows of Zeon tubular lamps—a total of 7,200 feet of fluorescent lamps.

SCIENTIFIC and TECHNICAL SERVICES

For many years the staff of this organization has served industry, both great and small—

LARGE INDUSTRIES HAVING RESEARCH LABORATORIES find these independent technical services to be of value in supplementing their own research . . .

SMALL INDUSTRIES LACKING RESEARCH LABORATORIES find in them an acceptable equivalent . . . and are thus relieved of the cost of maintaining research departments. But research facilities are available to them when, as and if required.

FEES ARE PAID ONLY FOR WORK PERFORMED

KNOW—BY TEST

Electrical Testing Laboratories, Inc.

HEADQUARTERS AND LABORATORIES
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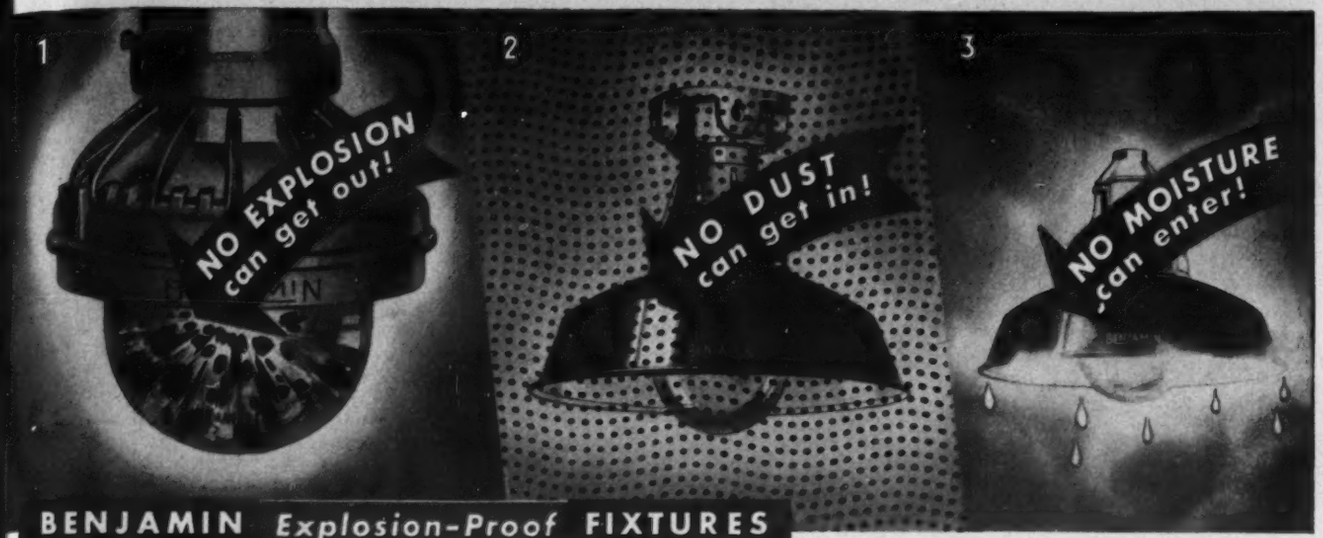
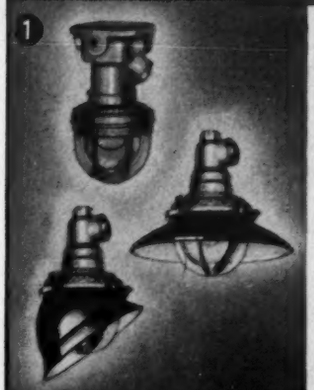
ELECTRICAL AND GENERAL TESTING • INSPECTIONS • RESEARCH • CERTIFICATION

Important Facts you should Know about Benjamin *Explosion-Proof*, *Dust-Tight* and *Vapor-Tight* Lighting Equipment



BENJAMIN *Explosion-Proof* FIXTURES

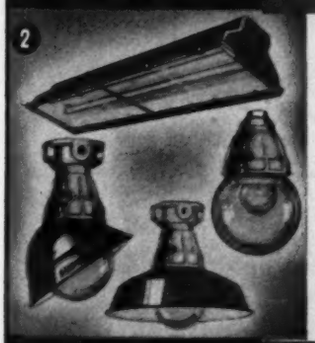


Constructed to:
Confine Explosions Within Fixture.

These units meet the severe spark plug test in which spark plugs are used to create ignition of explosive mixtures within the fixture 30 or more times. Tested also to withstand hydrostatic pressures ranging to 380 lbs. per sq. in. For Class C (Ethyl-Ether atmospheres) a series of 50 additional explosion tests are met. Benjamin units are neither destroyed nor damaged by such tests nor do they permit the passage of flames or dangerously hot gases to escape to the surrounding atmosphere. Further, they pass all tests for operation at safe temperatures below the ignition temperature of the explosive atmosphere.

Uses: Listed by Underwriters' Laboratories for Class I, Group C and D hazardous locations, which include locations where flammable volatile liquids, highly flammable gases, mixtures or other highly flammable substances are used, handled or stored in other than their original containers.

BENJAMIN *Dust-Tight* FIXTURES



Constructed to:
Prevent Penetration of Explosive Dust to Lamp and Operate at Safe Temperatures.

Tests passed by these Benjamin fixtures include: Dust-Tight Test, 6 cycles of on and off operation at maximum room temperatures in a whirlwind of explosive dust-air atmospheres; Temperature Test, safe operation of fixture when covered with a heavy blanket of ignitable dust; a 35-hour, 2000 r.p.m. Vibration Test.

Uses: Listed by Underwriters' Laboratories for Class II, Groups E, F, G, and Classes III and IV hazardous locations. Includes such locations where the air may become laden with combustible dusts or where easily ignitable fibers are present. Also where dusts may settle upon ordinary fixtures in excessive quantities.

BENJAMIN *Vapor-Tight* FIXTURES

Constructed to:
Exclude Harmful Amounts of Vapor, Gas, Water and Dusts from Interior of Fixture.

These fixtures are highly resistant to penetration of moisture and non-flammable dusts, gases, or vapors. They meet Benjamin's high standards for performance and their dependability is attested to by their years of service throughout industry.

Uses: Listed by Underwriters' Laboratories for Class II, Group G and Classes III and IV hazardous locations. Includes locations where non-flammable gases or vapors are present or where non-combustible dusts exist.

Severe Tests and Years of Service demonstrate Dependability of these Special Benjamin Fixtures

Illustrated here are the three groups of Benjamin fixtures for use in hazardous locations. Fixtures in each group must pass stringent tests for conditions far beyond those found in actual service. Some of these tests are given in the chart at left, together with typical applications for each group.

Benjamin's years of experience in the manufacture and installation of such fixtures give assurance of maximum protection against fires, explosions and lighting interruptions due to hazardous or other abnormal atmospheric conditions. In the solution of special lighting problems involving the use of such equipment, Benjamin's experience and engineering recommendations are available without cost or obligation. Write for Free Data Bulletins containing detailed information concerning all of Benjamin Hazardous Location Lighting Equipment bearing the label of the Underwriters' Laboratories. Address Benjamin Electric Mfg. Co., Dept. K, Des Plaines, Illinois.

BENJAMIN
TRADE MARK

HAZARDOUS LOCATION
Lighting Equipment

DISTRIBUTED EXCLUSIVELY
THROUGH ELECTRICAL WHOLESALERS

★ It is not enough that our fighting men should have more planes, guns, tanks and supplies than the enemy. They must also have the finest. Thanks in no little measure to See-ability, American arms today are the finest—as well as the "mostest." With See-ability to aid them, eyes that back the attack can now work to tolerances as close as 1/10,000th of an inch with speed and assurance. Under the See-ability conditions made possible by today's high-efficiency Westinghouse Mazda Lamps, precision work is done more efficiently in less time—with fewer errors and less fatigue.

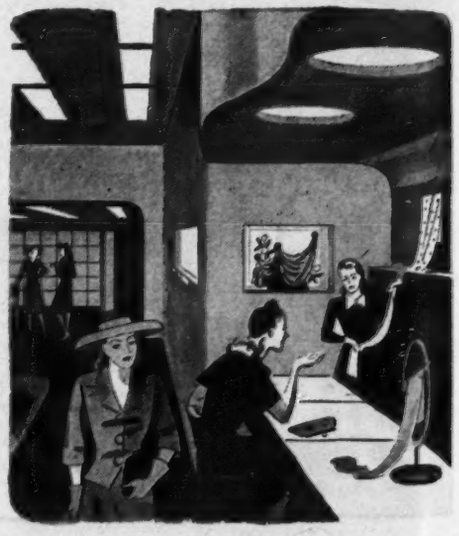
EYES THAT BACK THE ATTACK MUST BE SURE

When today's big war production job is done, these higher lighting standards developed by Westinghouse engineers will bring See-ability benefits to America's peacetime factories, offices, stores, schools and homes. For maximum See-ability and efficient, dependable service, be sure to recommend bright, long-lasting Westinghouse Mazda Lamps. Westinghouse Electric & Manufacturing Co., Bloomfield, New Jersey.

LET'S ALL KEEP BACKING THE ATTACK . . . BUY MORE WAR BONDS!

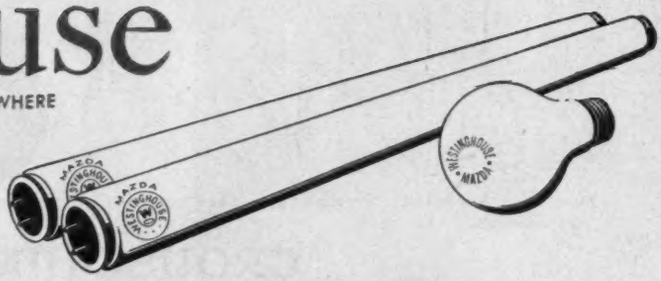
TOMORROW . . .

Soft, eye-easy fluorescent light for school rooms and many new and dramatic uses for light as a salesman in stores, are just two of tomorrow's lighting benefits predicted by Westinghouse engineers. Take advantage of Westinghouse technical progress and research in lighting, make high-efficiency Westinghouse Mazda Lamps a must in your light-planning for tomorrow. And for leadership in lighting, watch Westinghouse!



Westinghouse

PLANTS IN 25 CITIES .... OFFICES EVERYWHERE



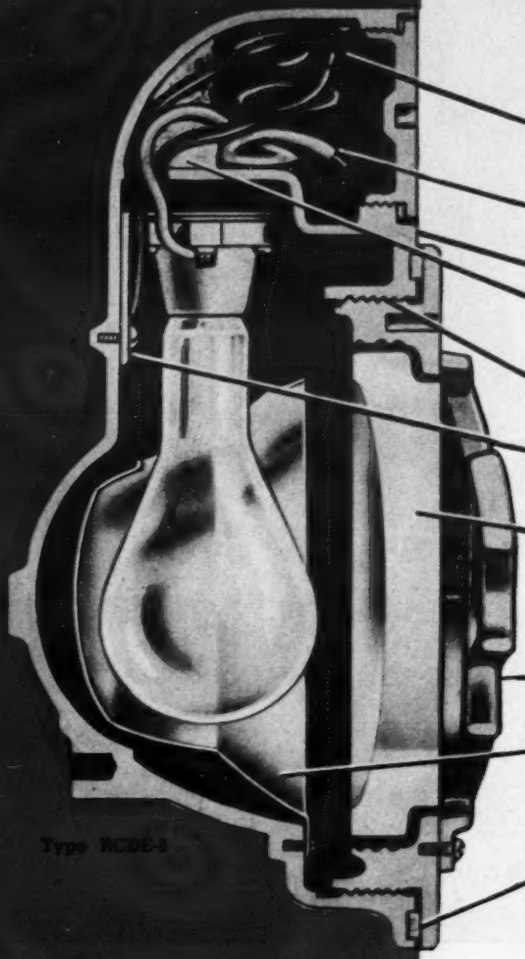
MAZDA LAMPS FOR SEE-ABILITY

WESTINGHOUSE PRESENTS JOHN CHARLES THOMAS • SUNDAY 2:30 EWT., N.B.C. • "TOP OF THE EVENING" • MON. WED. FRI. 10:15 EWT., BLUE NET.

In hazardous locations where ordinary floodlights are unsafe because of the presence of explosive atmospheres, you can solve the problem by installing

CROUSE-HINDS

Explosion-Proof FLOODLIGHTS



Type RCDE-6

Wiring chamber. Ample space for splicing. Easily accessible.

Asbestos covered leads. One wire is grounded to housing for safety circuit.

Cast aluminum or Feraloy (semi-steel) housing.

Factory sealed with sealing compound between wiring chamber and lamp housing. External seals unnecessary.

Flame tight threaded covers.

Adjustable receptacle bracket permits the use of 100, 150 and 200-watt lamps.

Impact and heat-resisting lens. A refracting screen can be furnished to direct the light in any direction, approximately 30 degrees from normal.

Sturdy grid for use where glass is exposed to breakage. Easily removed for cleaning lens.

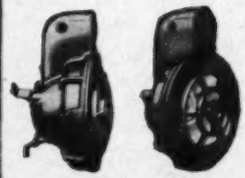
***Alzak aluminum reflector.** Wide beam for short range. Narrow beam for long range or spotlight.

Gasket of oil and gasoline resisting material furnished if needed.

Write for additional information.

**Alzak is the registered trademark of the Aluminum Company of America.*

Mountings, left to right: Portable; base; suspension; surface; for setting in concrete.



A Nationwide Distribution Through Electrical Wholesalers

Type RLEE-14
500-watt

CROUSE-HINDS COMPANY
SYRACUSE 1, N. Y., U.S.A.

Offices: Birmingham Boston Chicago Cincinnati Cleveland—Dallas—Denver—Detroit—Houston—Indianapolis Kansas City Los Angeles Milwaukee Minneapolis New York Philadelphia Pittsburgh San Francisco—Seattle—St. Louis—Washington *Resident Product Engineers:* Albany Atlanta Charlotte New Orleans
CROUSE-HINDS COMPANY OF CANADA, LTD., *Main Office and Plant:* TORONTO, ONT.

CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS

YOU PLAN
NEW LIGHTING LAYOUTS
BE SURE TO HAVE
OPERATING DATA
ABOUT....

this NEW LAMP

So perfectly does COLOVOLT meet today's lighting requirements that you will want to consider this new lamp before you put any proposed lighting layouts on the boards.

Of utmost importance, COLOVOLT frequently permits greatly improved lighting *without rewiring*. In fixtures with properly designed ballasts, COLOVOLT will operate on line voltages of 120, 220 or 440. If 220 volt ballasts are used on a 220 volt line, twice as many ballasts may be employed on existing wire size. If 440 volt ballasts are used on a 440 volt line, four times as many ballasts may be employed. The low striking voltage (750 volts) and low operating voltage (440 volts) increase the safety factor and reduce the fire risk.

With COLOVOLT, these advantages of low voltage operation are now added to the recognized features of cold cathode lighting. A full year's lighting can be guaranteed except for failure due to breakage . . . because the life expectancy of the COLOVOLT Lamp is actually 10,000 hours! Maintenance costs are correspondingly slashed. The COLOVOLT Lamp starts instantaneously . . . no starters needed, no flickering.

There's much more to be said about this new lamp. Complete information is contained in our book of "Facts About COLOVOLT." Write for your copy today!

GENERAL LUMINESCENT
CORPORATION
638 S. FEDERAL ST., CHICAGO 5, ILL.

Accessories and fixtures available from national manufacturers

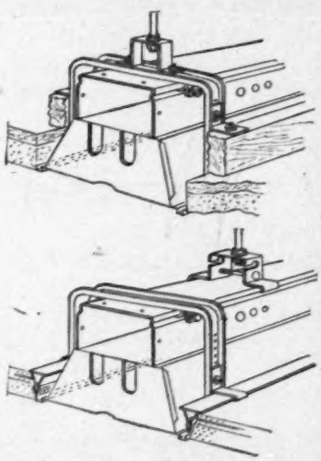
COLOVOLT

Cold Cathode Low Voltage

STANDARDIZED 93 INCH LAMP

... for the man who likes it straight from the shoulder!

THE MILLER TROFFER SIMPLIFIES FURRING



Miller Troffers can be hung directly from *structural* ceiling and, by means of patented Miller bracket, the *false* ceiling (either wood or metal frame) can be hung from Troffer. This greatly simplifies furring and adds to flexibility of installation.

We have just rounded out 100 years in the lighting business but we don't think about it that way. *We* figure we're just starting our *second* 100 years—with feet firmly braced on past experience and eyes on the future.

We believe — implicitly — that we have developed the best dawgonne continuous flourescent lighting systems the world has ever seen —seen BY—and seen BETTER by.

They have proved themselves, breaking lighting bottlenecks on our production front. By consistently delivering the goods, they have *earned* their place of foremost consideration in postwar planning of all kinds, including offices, stores and schools.

The Miller two-light Troffer, shown above* can be economically installed (recessed, flush or pendant) in almost any type ceiling. It is attractive—and practicable—in single units, combinations of units or continuous rows BY THE MILE. Its shallow dished panels offer a wide variety of designs. It is so versatile that its applications are almost as unlimited as the architect's ingenuity.

It is economical to service and encourages the benefical use of fully adequate lighting instead of eye-straining, pinch-penny methods.

As the huge wartime bulge in industrial lighting tapers off, new users of fluorescent lighting will fill the gap. Electric Utilities Companies can well encourage this healthy trend.

Miller Engineers are in principal cities and they are there to help lick lighting problems. So call in a Miller Engineer—or call us directly—and see what 100 well spent years have taught us.

**Shown now only for your advance planning.*

THE MILLER COMPANY • MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent
Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners
and Liquid Fuel Devices

ROLLING MILL DIVISION
Phosphor Bronze and Brass
in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Materiel

MILLER
SINCE 1844

Bottom Leads or End Leads

This One Ballast provides for both . . .

● For direct mounting on narrow wiring channels or fixtures, bring the leads out of the bottom.

For other applications, extend them from the ends. Insulated bushings set at an angle protect the leads either way.

Simplify your fluorescent lamp Ballast inventory,—reduce stock investment and save time. Order the new Ballasts now. Available in two-lamp 40-watt sizes with other popular capacities shortly. JEFFERSON ELECTRIC COMPANY, Bellwood (Suburb of Chicago), Illinois. In Canada: Canadian Jefferson Electric Co., Ltd., 384 Pape Avenue, Toronto, Ontario.

A MAJOR DEVELOPMENT OF VITAL IMPORTANCE

- √ No Duplication of Stock
- √ Lower Ballast Investment
- √ Fit Various Installation Requirements
- √ Conserve Manpower

JEFFERSON ELECTRIC

BALLASTS
FOR FLUORESCENT LAMPS

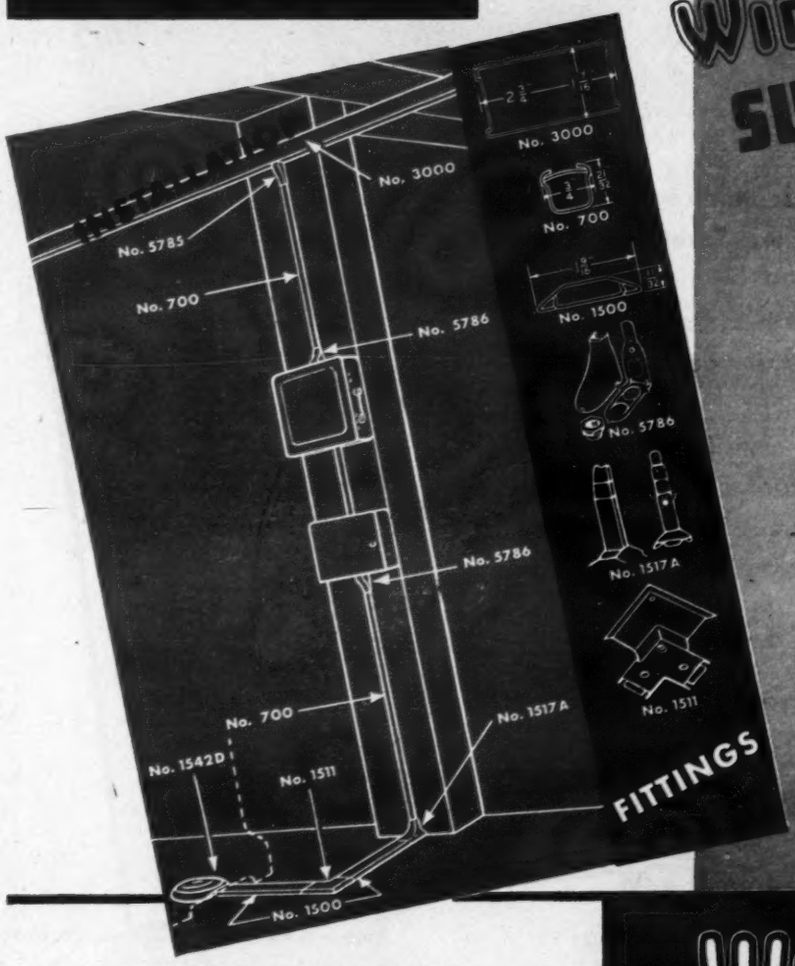
● *Instant Starting Ballasts now available in the two-lamp 40-watt sizes. These Ballasts make possible starting without separate starter action or cathode pre-heating, and will be furnished with leads for both bottom and end positions.*

the problem

Simplified wiring of small motor-driven machines

the answer

WIREMOLD SURFACE METAL RACEWAYS



● Shown in the photograph above and the diagram at the left is the wiring layout for a group of small presses. This clean, efficient, safe installation required no costly channeling of floors and eliminated drop connections from overhead wiring. It demonstrates how Wiremold Raceways interconnect one with another to meet widely varying installation needs. Here No. 3000 is used to carry sub-feeders, with take-off at each station through No. 700 to motor controls, and to No. 1500 Pancake across floor, completing connection to the machines.

Strong and safe, Wiremold Raceways are easily and quickly installed and are available, with their fittings, in a range of sizes and capacities to meet the installation needs of every type of building. Engineering data sheets covering the above installation and many others, also new Industrial Wiring Bulletins are available on request.

WIREMOLD CAN HELP YOU PRODUCE FOR WAR . . . WHILE YOU PLAN FOR PEACE!

KNOW YOUR

WIREMOLD

AND YOU KNOW THE ANSWERS

NEMA

THE WIREMOLD COMPANY HARTFORD 10, CONN.

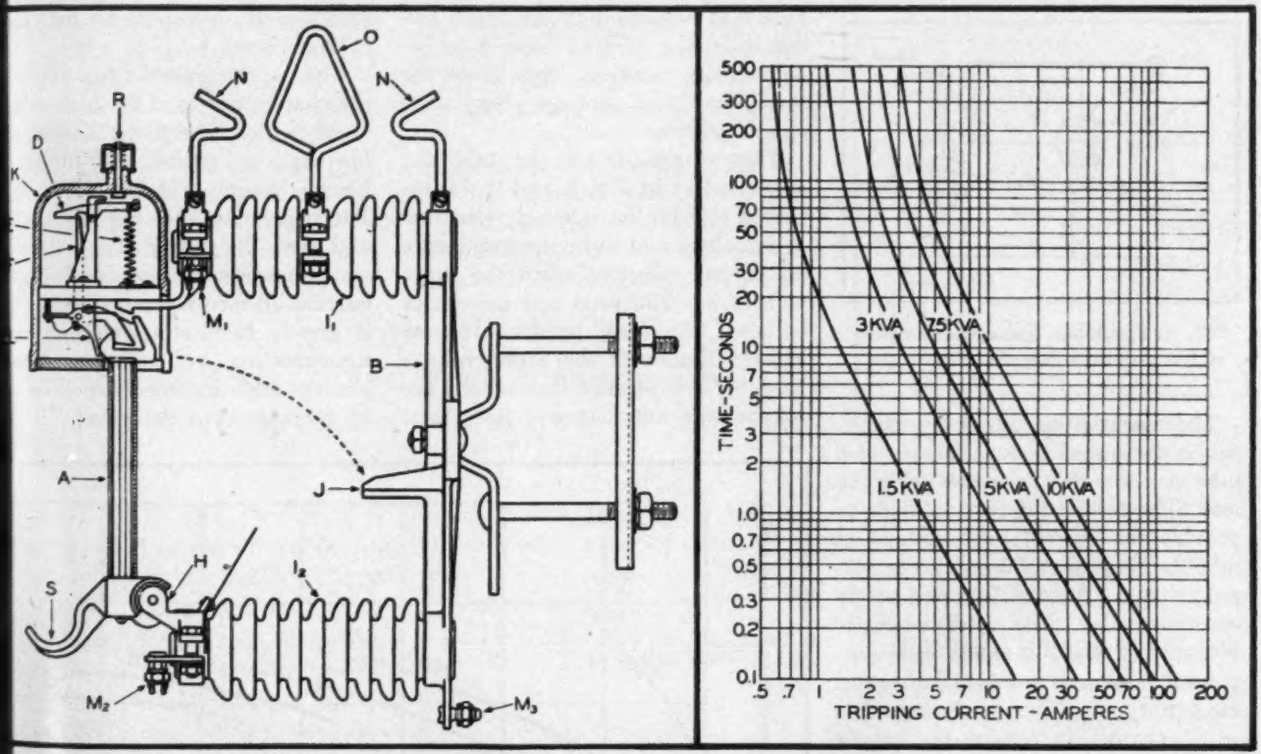
How

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

Tripping Mechanism Replaces Cutout Fuse

A tripping mechanism consisting a plated thermostatic bimetal ele-ent, hook, latch and pressure con-ct has removed the necessity of pri-ary or secondary fuse links in cut-ts or other types of transformer otection on rural lines. This W. N. atthews Corp. (St. Louis, Mo.) development is part of a fuseless cutout which can be mounted either vertically or horizontally on cross arm, pole or transformer case.

Cutout was designed for use on the typical single-phase multigrounded circuit and to withstand a potential of 7,500 volts. An abnormal current which may result from a transformer failure or secondary line trouble will cause the coiled bimetal element to contract in accordance with predetermined time current characteristics shown in the accompanying diagram. As soon as this contracts far enough to release the contact arm, the circuit



UTOUT IN WHICH a tripping mechanism replaces fuse. Upper insulator supports tripping mechanism which consists of element E), hook (D), latch (F), and contact (L). Housing (K) protects mechanism from the weather, birds and animals. Lower insu-tor supports the hinge (H) to which the arm (A) is pivoted under spring tension. Latch holds the contact arm against e contact by engaging the dog on the contact arm. When the contact arm is released, it snaps to ground connection (J) s shown by the arrow. Phase wire is attached at (M_1), transformer lead at (M_2), and ground wire at (M_3). Can be manually ipped by striking plunger (R) with a hot stick. Downward pull on hook (S) with hot stick swings contact arm into closing osition. Can be installed on pole, arm or transformer case in either a vertical or horizontal position

is in most cases, instantly broken. In certain instances the inductive reactance of the line may prevent the arc from being extinguished before the arm reaches the grounded contact. In such an instance a line-to-ground fault would be established. This results in instantaneously building up a short circuit value sufficiently great to operate a back up reclosing device. Either a reclosing fuse switch or an automatic reclosing circuit breaker for this reason is installed on the line side of the new device.

• • •

Voltage Stabilizer Gives Fine Control

A new electronic stabilizer and regulator for d.c. voltages when connected to a convenient d.c. supply absorbs some of the voltage (100 to 150 volts) and delivers the remainder in a stabilized condition to the output circuit. The standard voltage against which this output voltage is compared by this device is provided by a dry battery. This has a long life since it does not supply any current to the circuit. Arvon Glynne, College of Technology, Manchester, in a paper presented before the (British) Institution of Electrical Engineers further states that the d.c. input voltage should be adjustable; that this may be had from the usual sources, but that if a rectifier is used the unit is portable and complete within itself.

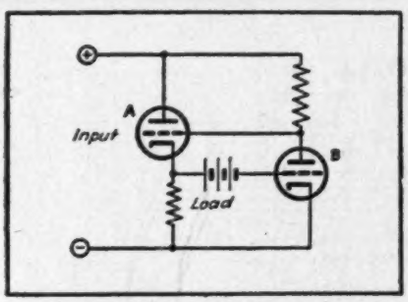


FIG. 1. Simplified connection diagram of the stabilizer described

The essential circuit of the stabilizer is shown in Fig. 1. It consists of a tube A connected in series with the load. The second tube B functions to provide the correct grid voltage to tube A, thereby maintaining the output voltage of the stabilizer at a nearly constant value. The grid-to-cathode potential of tube B is equal to the output voltage minus constant voltage of the battery, the difference being a few volts negative. Increasing the supply voltage produces some increase in the output voltage, which raises the grid potential of tube B, thus increasing the anode current and making tube A grid negatively stronger. The result is that the greater part of the increase is counteracted by tube A. Conversely, an increase in load current reduces the output voltage causing the grid of tube B to become more negative, and therefore, the grid of Tube A to become more positive. This gives the stabilizer good voltage regulating characteristics.

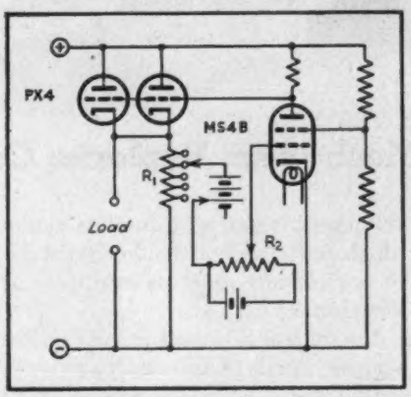


FIG. 2. A circuit resulting in improved voltage control. See Figs. 3 and 4

Tests were made with the stabilizer, connected as in Fig. 1, and it was reported to have an internal resistance of 5.1 ohms and to be approximately 95 percent effective when the input voltage was 230 volts and the output voltage 160. The results obtained showed that with the input voltage held to one percent fluctuation, the output was automatically held to a variation of 0.01 percent or less.

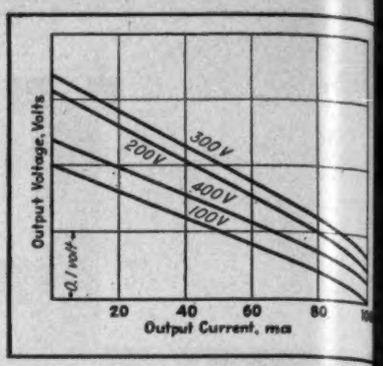


FIG. 4. Effect of load changes on output voltage of stabilizer in Fig. 2

An improved circuit, Fig. 2, is an elaboration of Fig. 1, with a tetrode (British MS4B, American H42) substituted for one of the triode tubes in Fig. 1. There also are two British PX4 tubes with their screen voltages supplied through a variable resistor connected across the input voltage. Therefore, an increase in the supply voltage raises the screen voltage and, consequently, increases the effectiveness of the tube by increasing its grid voltage. This is a true stabilizing action and accounts for the improved results obtained as shown by the curves in Fig. 3. The performance of the stabilizer improves progressively as the output voltage rises.

The paper resulted from reviewing the characteristics of the high voltage supply which is required in meter testing stations established under the Electric Supply (Meters) Act, 19[illegible]. The paper describes the construction and gives the theory of the stabilizer which has been constructed to provide current at a voltage so constant that it greatly facilitates precision measurements on voltmeters and watt-meters. Also included are other uses of the apparatus described.

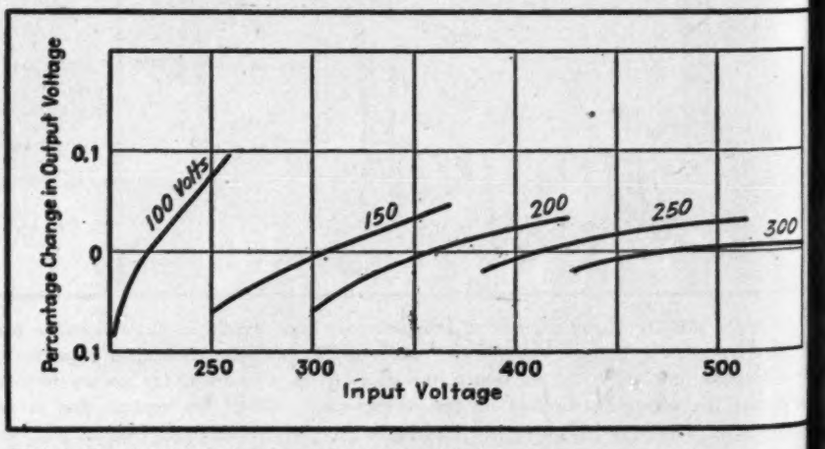


FIG. 3. Results obtained from stabilizer shown above in Fig. 2

WORKMAN (above) lifting manhole cover by the use of a hook having safety "spurs." Details of the altered hook which prevents slipping while raising the cover are shown in lower right. Process at the same time, due to the leverage, is made easier as well as safer, preventing barked fingers and shins while removing 252-lb. cover

Heavy Cover Removed Without Backstrain

By brazing "spurs" on manhole over hooks as illustrated, the hook ill not slip when prying manhole overs, and the danger of straining e back while trying to lift the cover nd pull to one side at the same time, removed. A hook so altered not only akes possible prying instead of lift-g, but goes further than the con-ntional hook in that the cover is not only raised up, but is pulled slightly to one side.

The hook is not only a safety measure, but makes the job of removing heavy manhole covers much easier. The idea was developed by John Godvig, underground department, Northwestern Electric Co., Portland, Ore., as a safety suggestion and an easy manner of removing the 252-lb. cover.

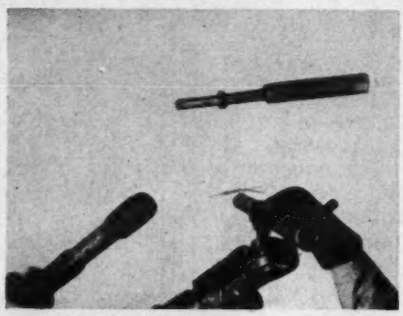
• • •

Ground Rods Driven With Jackhammer

By JOSEPH J. BEELER
Pacific Gas and Electric Co.
Sacramento, Calif.

Driving of ground rods with a eumatic jackhammer provided with driving socket has proved a time ver in the Sacramento division of acific Gas & Electric Co. The cket or tool as illustrated, consists a short piece of round steel stock ith a hole in one end to fit over the ound rod and a piece of paving eaker gad welded to the other end to into a jackhammer.

Station maintenance crews have en driving ground rods by this ethod for several years with a great saving of time where grounding systems are being installed.



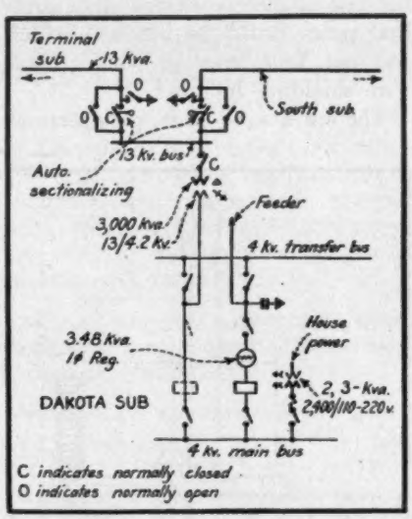
JACKHAMMER with socket saves time in driving ground rods

Motor Operated Air Switches Save O. C. B.'s

By L. M. ROBERTSON*
Public Service Co. of Colorado,
Denver, Colo.

Two motor-operated air-break switches solved the problem of connecting a 3,000-kva., 1¾-kv. substation to a 13-kv. tie line between two principal substations and of sectionalizing the line at this point, without the use of oil circuit breakers. The two main substations are kept in synchronism by other ties.

In case of a fault on the tie-line, circuit breakers trip at both ends, but the one at Terminal substation (see accompanying diagram) immediately recloses. If the fault is cleared, there is no operation of the air-break switches, and the circuit breaker at South substation recloses and restores the normal operating condition. If, however, there is a permanent fault between the two main substations, the



CONNECTIONS employed in utilizing two motor-operated air-break switches for sectionalizing tie line and providing alternate feed to distribution substation

Terminal breaker will again trip and in 10 sec. both air-break switches will open. In an additional 20 sec. the Terminal breaker would close and in this case trip and stay out. Also, at the same time, the circuit breaker at South substation will close and the potential transformers at Dakota substation will receive an indication of voltage and the air-break switches on this side will close, picking up the station.

*Transmission and Substation Engineer

A similar procedure would result if the permanent fault were on the line to South substation. Operating power is supplied for the two motor-operated air-break switches from a 24-volt storage battery. This switching arrangement has proved to be satisfactory and served the purpose of protecting an important link between two substations. This was done at much less cost than with the use of oil circuit breakers.

•

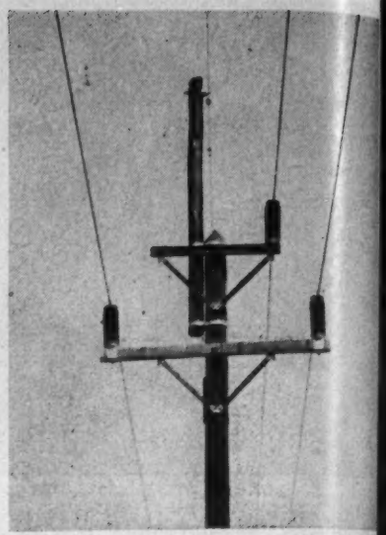
Stub Poles At Top To Hold Ground Wire

Pole stubbing, ordinarily used at the base of poles to increase useful life, has been shifted by Central Illinois Public Service Co., Springfield, to the pole-top to support a grounded overhead shield wire in the case of an 11.6-mile line section recently converted from 34.5 kv. to 69 kv. operation. The step considerably reduced the cost of the conversion since original poles could be retained which had not been selected with ground wire shielding in mind.

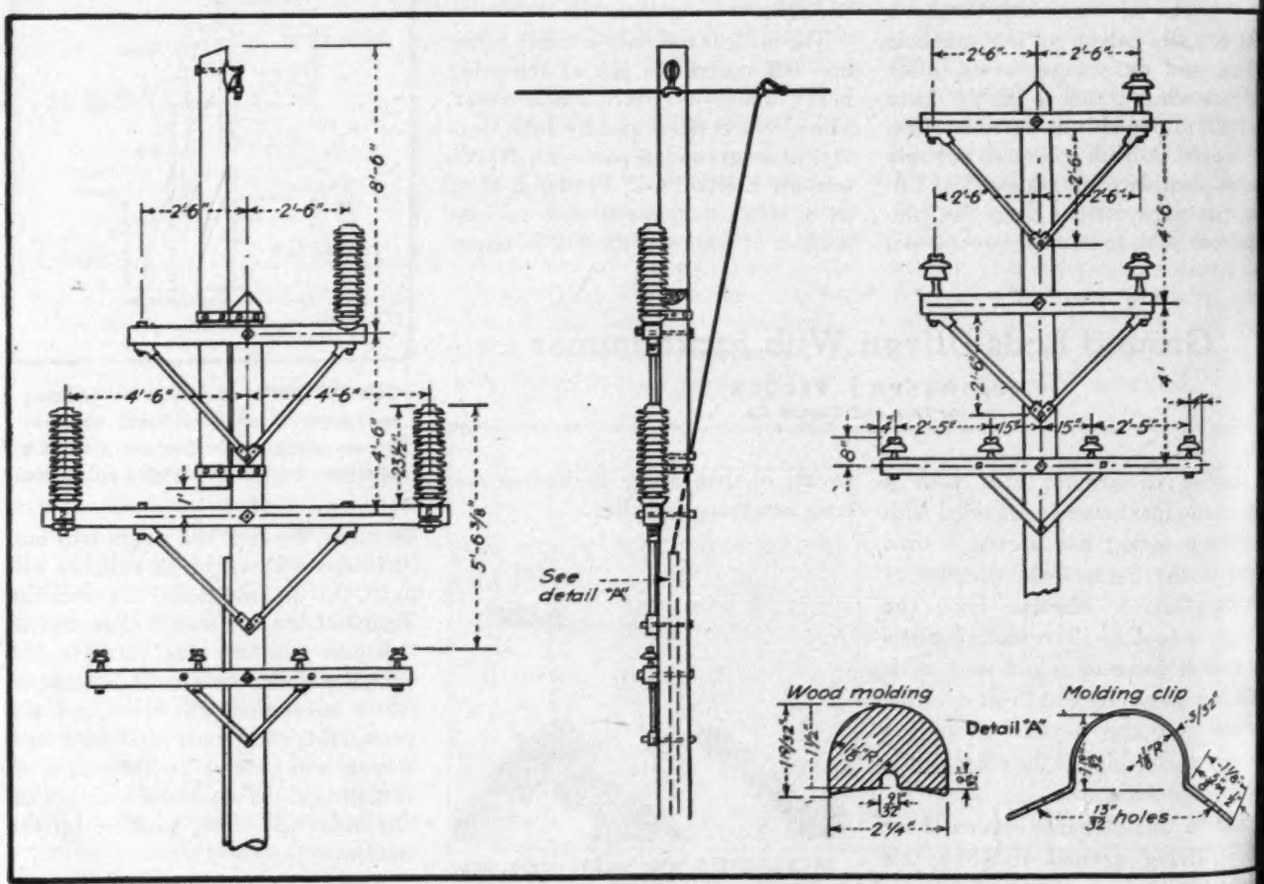
The stubs were 12-ft. pole sections that overlap the top of the existing pole five feet, bringing the top of the stub 8 ft. 6 in. above the center line of the top cross arm. Conventional stubbing bands were used as the fastening.

Arrangement of the converted pole top is compared with the original 34.5-kv. configuration in the accompanying illustrations. The original two-piece, pin-type insulators of the 34.5-kv. construction have been replaced with 23½-in. line post units and 4¾ x 5¾-in. x 10-ft. cross arm substituted for the original 3¾ x 4¾-in. x 5 ft. 8-in. arm that supported the bottom transmission conductors.

The ⅜-in. S.M. static wire, grounded at each structure, is supported from the stub by a convential static suspension clamp. Particular attention is invited to the step that was taken to keep tension in the 2/0 stranded copper ground wire lead at each pole from ripping away and enclosing moulding. The top two feet of moulding is 2½ x 1 19/32-in. in sectional dimension and fastened to the pole with steel clips and lag screws. The rest of the unstressed moulding is the conventional ½-in. size fastened with the usual 1 x 3-in. staples on 2½-ft. centers. Use of this extra-heavy "anchor" moulding has eliminated former trouble with down-lead ground wires pulling out of moulding and endangering the line. Not only did it make possible increasing of the voltage but a trim and neat line resulted as is so vividly shown in the accompanying illustration.

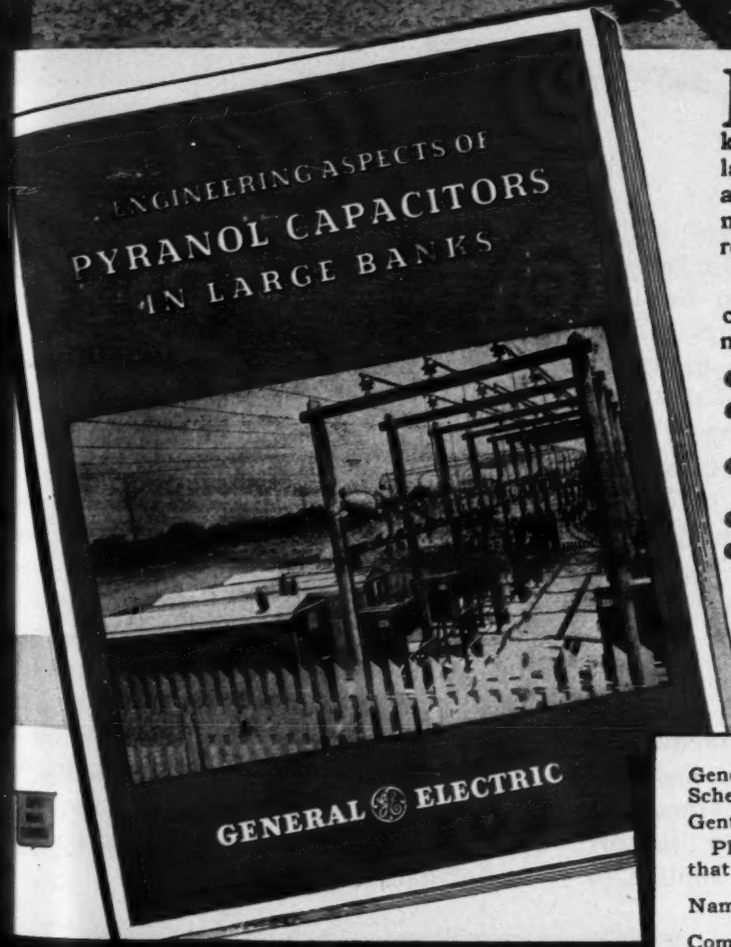


STUB ADDED to top of existing pole avoids extensive replacement in converting 11-mile 34.5-kv. line to 69-kv. operation. Cost greatly reduced



BEFORE (right) and after drawings of 34.5-kv. line converted for 69-kv. operation; 12-ft. pole stub supports grounded shield wire

How to apply capacitors in large banks



IN the past two years a quarter of a million kva of Pyranol* capacitors has been installed in large banks *near the load*. One power company after another has taken advantage of this simple, material-saving way to supply reactive kva and release system capacity for war loads.

This new booklet contains answers to practically everything you might want to know about making such capacitor installations:

- Reasons for locating kilovar sources near the load
- Economies that can be effected by the use of capacitors
- Relative merits of synchronous condensers and capacitors
- Types of capacitor equipment available
- Application requirements and problems (How to mount, connect, fuse, switch, control, protect from lightning, etc.)

*Reg. U. S. Pat. Off.

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GENERAL ELECTRIC

"7 YEARS' CONTINUOUS OPERATION, ...NO FILTERING, MAINTENANCE NEGLIGIBLE"

...REPORTS A NEW ENGLAND COMPANY ON ITS EXPERIENCE WITH A 10,000-KVA, 66-KV PYRANOL POWER TRANSFORMER

SEVEN years ago the engineers of this New England utility needed a 10,000-kva, 66,000-volt transformer to be used between a water-wheel generator and a high-voltage bus. They wanted to install the transformer *indoors* to avoid the high cost of long runs of heavy copper. They also wanted to avoid concrete cells with specially designed drainage facilities. Hence a noninflammable transformer was needed—one that would not require a fireproof vault and yet would provide the greatest degree of safety.

Pyranol* transformers, although introduced, commercially, only four years before this, had already proved themselves for indoor applications. Never had one burned or contributed to a fire. Operating records were uniformly excellent. But, for the most part, these had been applied to handle relatively small amounts of powe low or moderate voltage.

These engineers reasoned, and righ so, why shouldn't a noninflammable Py nol transformer be the economical cho for this large-capacity, high-voltage app cation? So a Pyranol power transform was selected.

The wisdom of this choice has be amply demonstrated over the past se years. The transformer has been in alm continuous operation, carrying vary loads up to its maximum rating. Sample the Pyranol liquid have been taken fr the transformer every year, and in each c analysis has proved that the Pyranol maintained its original high quality. T time and expense of filtering have be avoided; there has been little need maintenance of any kind.

Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds.

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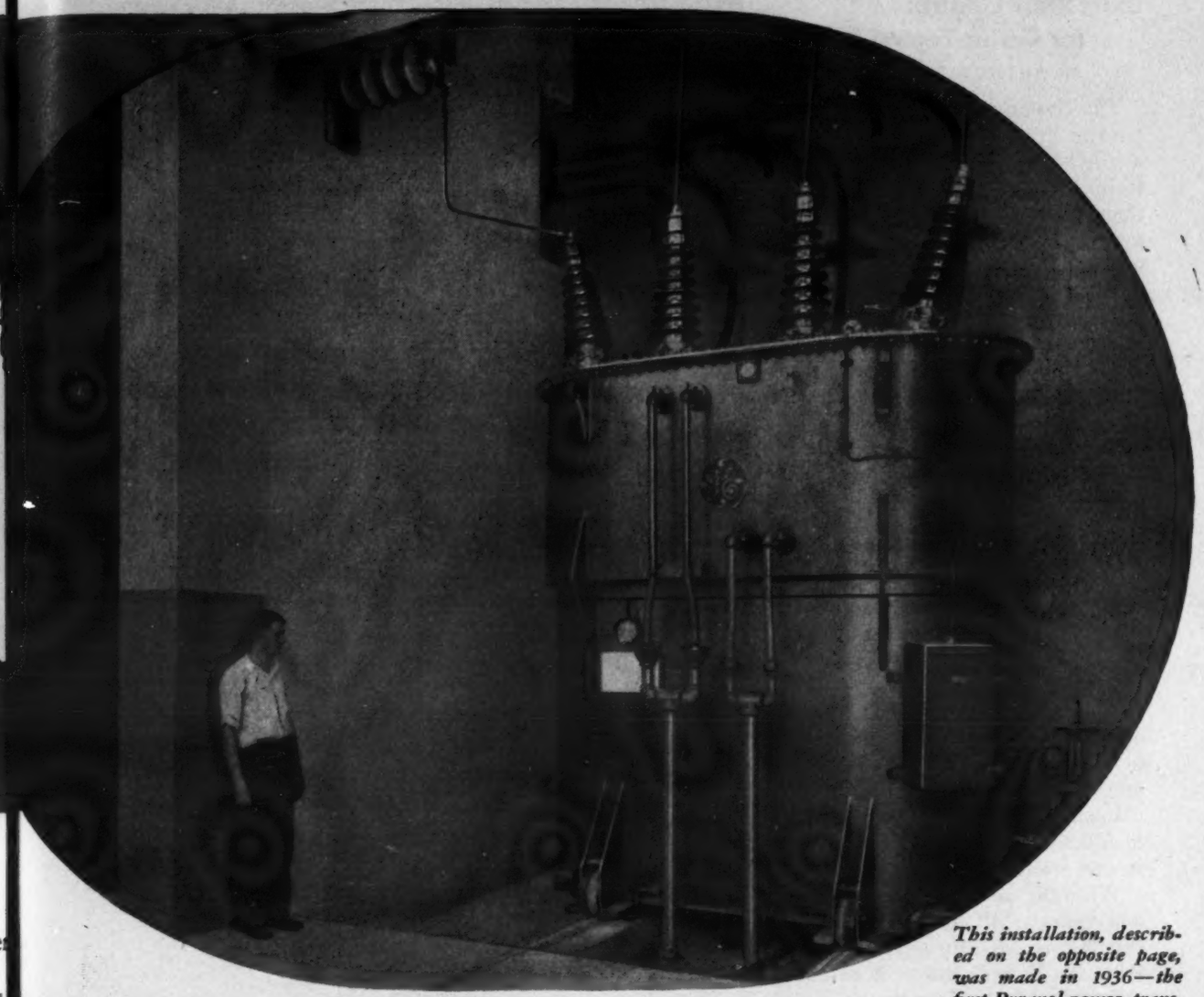

This installation, described on the opposite page, was made in 1936—the first Pyranol **power** *transformer application.*

THE benefits of Pyranol transformers, which have made them famous for distribution applications indoors, are just as real for *power-transformer* applications. For example:

- You can install them anywhere you wish, indoors or outdoors.
- Their inherent safety means that fireproof vaults or other fire protection is not required. Construction materials and installation time can often be saved.
- Pyranol is a stable liquid. It is nonoxidizing and nonsludging, and has high dielectric strength. Filtering is seldom, if ever, required.

It will pay you to consider the advantages of Pyranol for your transformer installations—large as well as small—wherever the elimination of fire hazard is an important factor. Ask for Bulletin GEA-4193. *General Electric Company, Schenectady 5, N. Y.*

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GENERAL ELECTRIC

Start-Stop Control for Gang-Tested Meters

By ARTHUR B. CRAIG*

The Boston Edison Co. has incorporated in its latest gang test boards a novel and efficient means for controlling the comparative test revolutions of the standard meter and the meters being checked. Essentially the scheme utilizes a combination mechanical and electrical device which starts and stops the meters being tested without adding any appreciable amount of friction to the standard meter.

The operation of the control circuit is as follows (Fig. 1):

The standard meter is put into operation when the series current circuit of the meters under test is energized. On each revolution of the standard meter disk, a small stud attached to the shaft trips a counterbalanced stop arm. A spiral spring is at once released and instantly rotates a set of cams which in turn allows contacts "A" to come together. The tripping operation also allows the small motor to make one revolution. The design and setting of the two cams are such that contacts "A" are together for less than 0.2 sec. and are completely reset in one revolution of the small motor.

When the starting button is pressed and contacts "A" are together, the circuit is completed through a notching relay. An 11-tooth ratchet is advanced one tooth, which effects the closing of contacts "B." This in turn completes a circuit through the relay: thus voltage is applied to the potential coils of the meters and the test run is started. The starting button is then released and the potential coils of the meters under test remain energized for ten complete revolutions of the standard meter disk. The meters under test will automatically stop when the standard has made ten revolutions because the 11-tooth ratchet will then have returned to its starting position and contacts "B" will have opened, thus breaking the relay circuit.

This control circuit, being entirely automatic and positive in its operation, permits successive runs to be made with a high degree of accuracy and consistency. Its construction is compact and relatively inexpensive. It is easily maintained and has been found thoroughly satisfactory for this particular application.

* Head of meter technical division, Boston Edison Co.

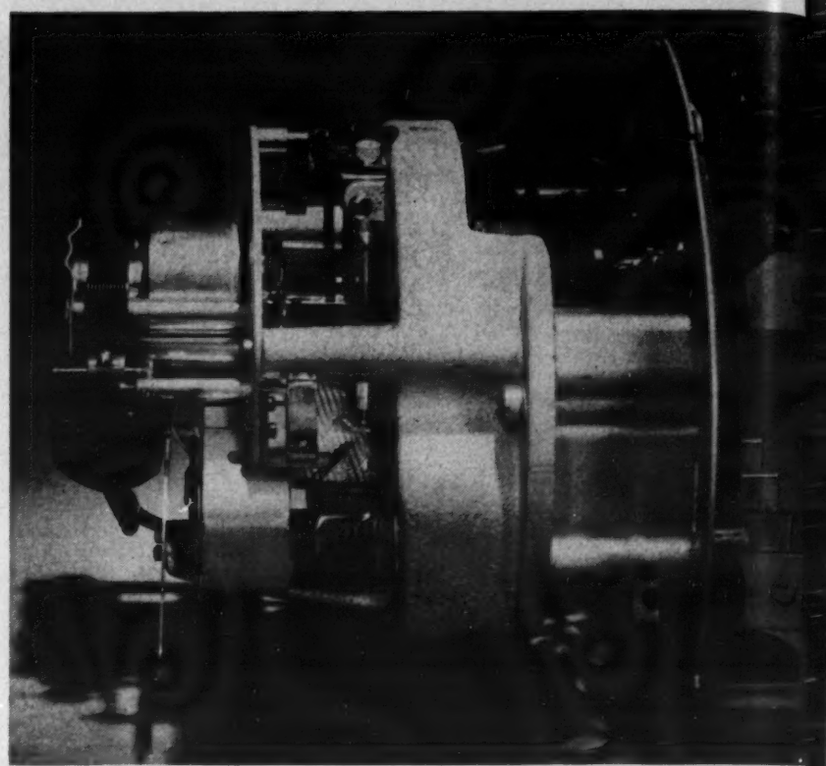

FIG. 2—Combination mechanical and electrical device for starting and stopping me

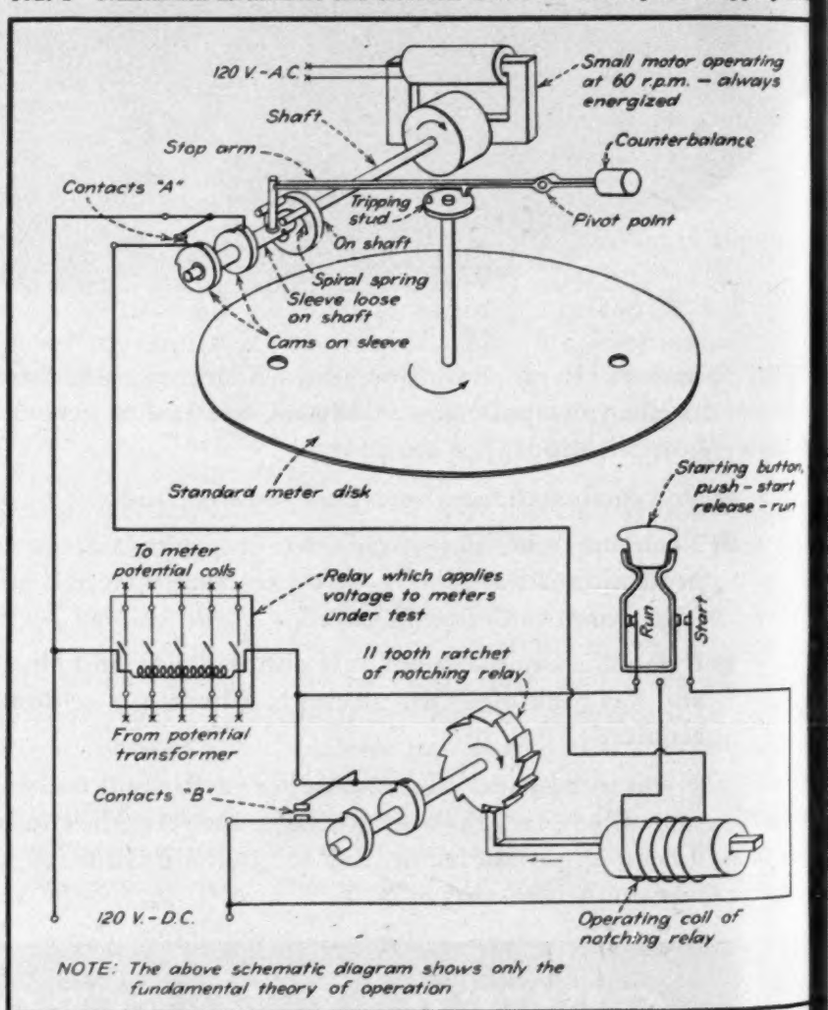

FIG. 1—Schematic diagram of control circuit for meters under test

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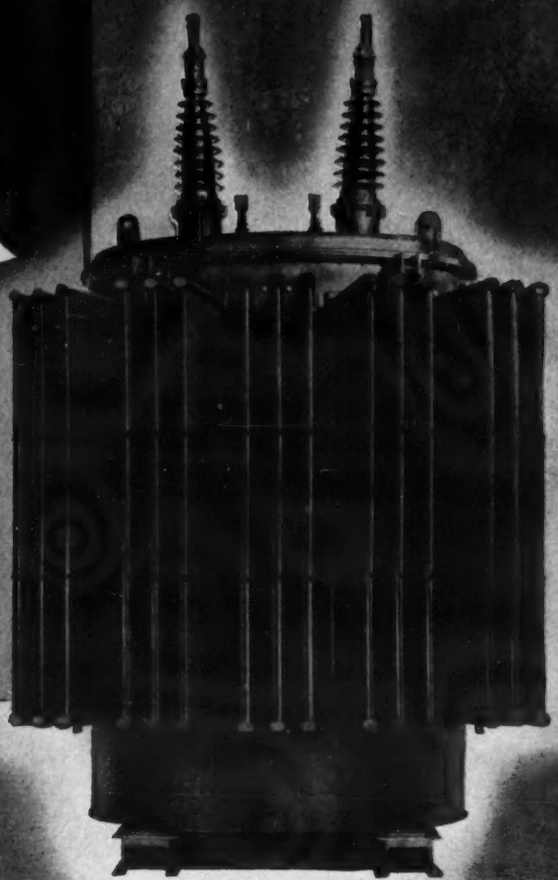

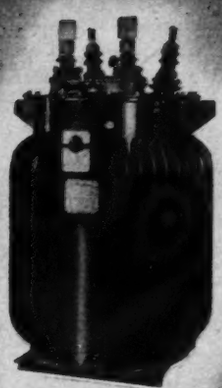

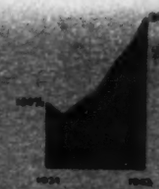

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(Statistics shown in graphs courtesy of E.E.I.)

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Pennsylvania TRANSFORMERS

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DISTRIBUTION TRANSFORMERS
LIGHTNING PROTECTION DATA

Data collected on distribution transformer lightning protection by the Transmission and Distribution Committee of the Pennsylvania Electric Association from 17 operating companies serving an area of about 45,000 square miles showed a total connected single-phase transformer capacity of 2,376,450 kva. The average transformer size for 1943 was 11.6 kva.

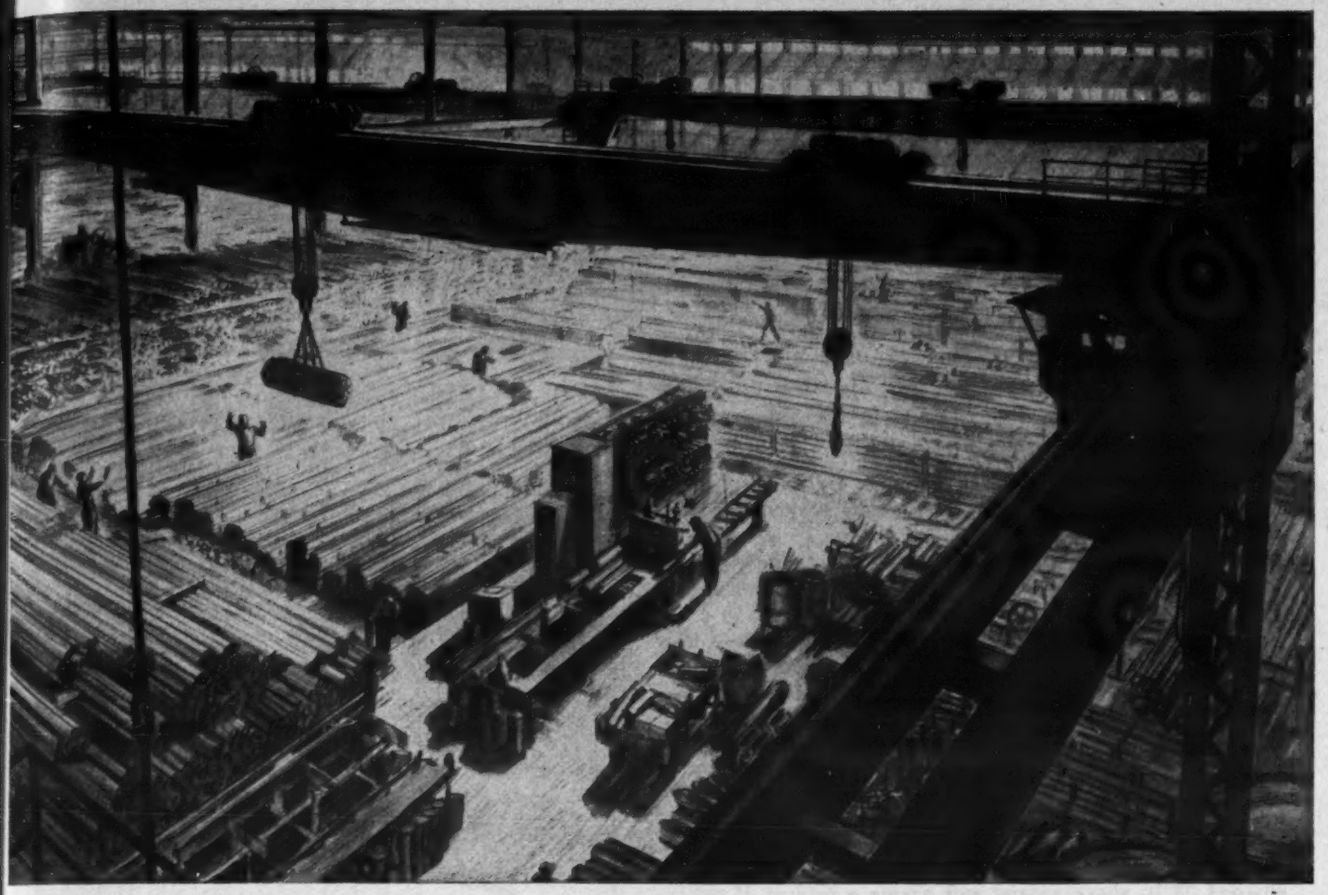
Summary of transformer failure rates for the past three years:

Type of Transformer and Connection	Failures Per 100 Transformers		
	1941	1942	1943
External Protection	0.64	0.57	0.59
Interconnected	0.63	0.52	0.49
Non-Interconnected	0.66	0.79	0.86
Without Protection	1.29	1.60	0.92
Self-Protected	0.34	0.30	0.38
Completely Internally-Protected	0.42	0.28	0.40
GRAND TOTAL	0.59	0.56	0.57

Figures indicate that the flat part of the curve for decreasing failure rates due to improved practices has been reached, and that varying storm conditions now have a major influence on the failure rate from year to year. Transformers with external protection represented 87.7 percent of the total in 1943 and has the least variation in failure rate. Transformers without protection represent 1.9 percent and has greatest variation; probably in relatively shielded areas and consequently show a smaller failure rate than would otherwise be obtained. Following is a numerical picture of the transformers involved.

Summary of Transformer Data

	Transformer size	Totals			With external lightning protection			Without lightning protection	Self protected	Complete internal protection
		1941	1942	1943	Interconnected	Non interconnected	Total (see note 1)			
Transformers in service	5 Kva. and under	104516	116528	117062	Figures below heavy line show sizes of groups for which statistical data were submitted.					
	7½–15	47060	53381	53607	Note 1. Some companies did not distinguish between interconnected and non interconnected transformers.					
	20 Kva. and over	32547	34893	34698	Note 2. Companies with these numbers of transformers reported on fuse blowings.					
	Total	184123	204802	205365	Note 3. Secondary breaker tripping rate.					
					128738	47823	180009	3904	8099	13514
Transformer failures		1082	1152	1178	325	240	1057	36	31	54
No. of transformers		184123	204703	205526	66594	27962	180009	3904	8099	13514
Failures per 100 transformers		0.59	0.56	0.57	0.49	0.86	0.59	0.92	0.38	0.40
Fuse blowings		8824	6474	6774	1305	551	4429	514	1322	31
No. of transformers (See note 2)		91946	101414	97079	39475	20277	69514	3904	6185	5449
Fuse blowings per 100 transformers		9.60	6.38	6.98	3.31	2.72	6.37	13.18	21.37	0.57 (see note 3)



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RYERSON STEEL-SERVICE

METHOD FOR DETERMINING SIZE OF GUY FOR A GIVEN LOAD

By F. W. NIMMER, General Distributing Engineer, Ohio Edison Co., Akron, Ohio

The accompanying charts are used in the sequence listed to determine the distribution line angle, horizontal conductor pulls at various angles, height and lead of guy and finally the size of guy

In some territories conductor tensions are limited to 2,000 lb. (Curve 7) for urban construction and to 60 percent of ultimate strength for rural lines. Cuves for railroad crossings comply with the Ohio Public Utilities Commission's orders.

Actual guy tension may be obtained in Fig. 4 by striking an arc from the intersection of the radial line with the tension ordinate down to the abscissa and read the actual value in pounds. The 11,000 lb. arc intersects the abscissa at the 11,500 lb. value which is the actual strength value of the 11,000 lb. guy.

Example

Given: Three single-conductors of No. 6A copperweld on a rural line dead-ended in the top gain of a 35-ft. pole. Guy attached 28 ft. above ground and having a lead of 15 ft.

Procedure: From Fig. 2 curve 6 the dead-end pull (15 units or 60-deg. angle) of one No. 6A conductor is 1,820 lb., and for three No. 6A conductors is 3 x 1,820 or 5,460 lb. pull. In Fig. 4 project horizontally from 28-ft. height to 15-ft. lead, thence radially to 5,460-lb. pull. This latter point falls just within the 11,000-lb. guy area, indicating that a 11,000-lb. guy is required.

Method to Determine Line Angle

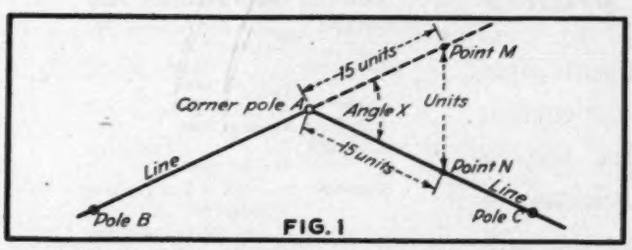


FIG. 1

Refer to Fig. 1: Start at corner pole A, measure off 15 units in a straight line with poles A and B and mark point M. Similarly locate N in line with poles A and C. Measure between N and M and, using this distance in same units, refer to the following table to determine angle X in degrees.

Units Required For Given Angle

Angle X, degrees	Distance, N to M, units	Angle X, degrees	Distance, N to M, units	Angle X, degrees	Distance, N to M, units
10	2.5	40	10	70	17
15	4	45	11.5	75	18
20	5	50	12.5	80	19
25	6.5	55	14	85	20
30	8	60	15	90	21
35	9	65	16	..	..

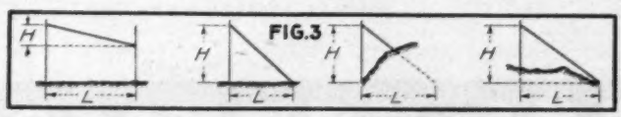
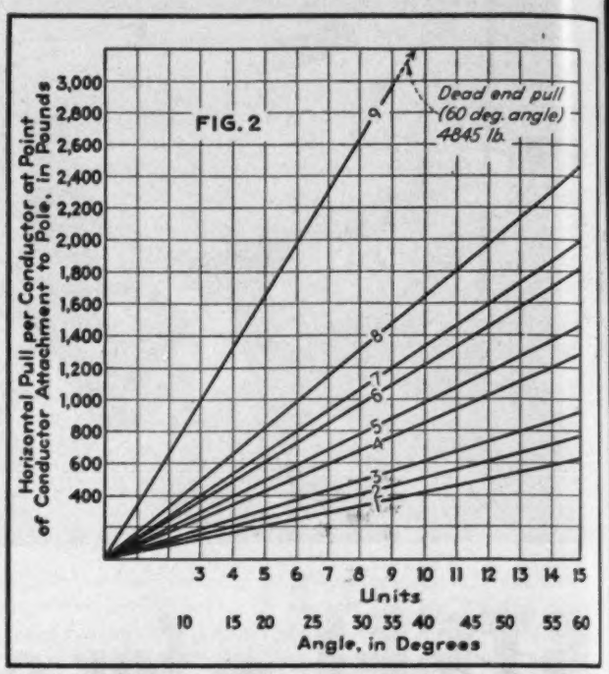
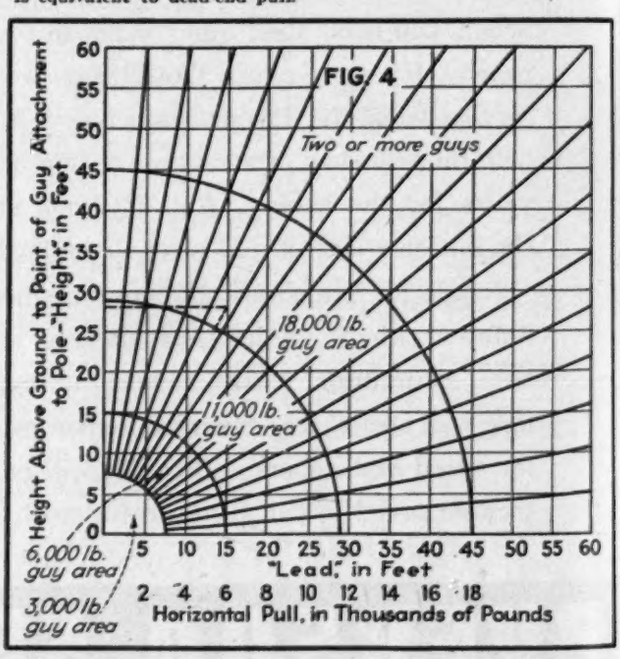


Fig. 3—Method to determine guy height (H) and lead (L)



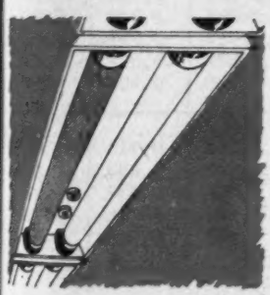
References for curves in Fig. 2: Curve 1—No. 6 copper for city lines and railroads. Curve 2—No. 6 copper for rural lines. Curve 3—No. 4 ACSR for railroads. Curve 4—No. 4 ACSR for rural lines, also No. 3 copper No. 6A Copperweld and No. 2 ACSR for city lines and railroads. Curve 5—No. 3 copper for rural lines. Curve 6—No. 6A Copperweld and No. 2 ACSR for rural lines. Curve 7—2,000 lb. limitation. Curve 8—No. 1/0 copper for any line. Curve 9—No. 4/0 copper for any line.

Note: Resultant measurement of 15 units or 60-deg. angle is equivalent to dead-end pull.

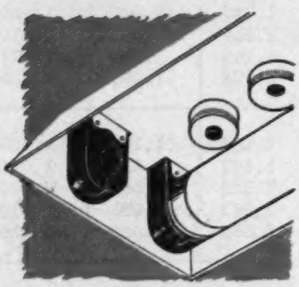


Reset It... Forget It

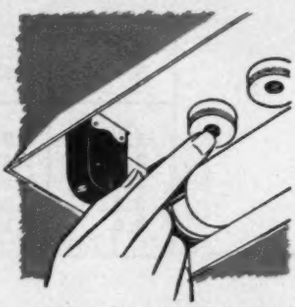
Here's how the G-E Watch Dog Fluorescent Starter reduces lighting maintenance to the simple operation of pushing a red button before relamping. It's so easy—just reset it and then forget it.



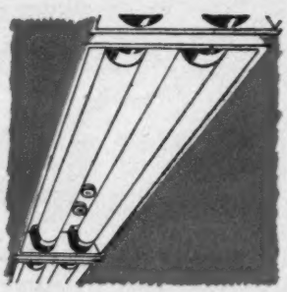
When the lamp dies the Watch Dog cuts itself out stopping annoying blink and flicker.



Manual reset button pops up eliminating futile and needless starting attempts.



When dead lamp is removed the Watch Dog is easily reset by pressing the red button.



New lamp is inserted in lampholder and it immediately begins to operate normally.

For additional information write to Section G741-9, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Connecticut.

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GENERAL ELECTRIC

TABLE OF RESISTANCES OF LEAD CABLE SHEATHS†

By L. G. McDOWELL*

The accompanying handy table gives the resistance of the lead sheath of cable in terms of the outside diameter of the sheath and the thickness of the sheath.

The values of resistance are given in 10^{-4} ohms per foot, or ohms per 10,000 feet, at 70 deg. C.

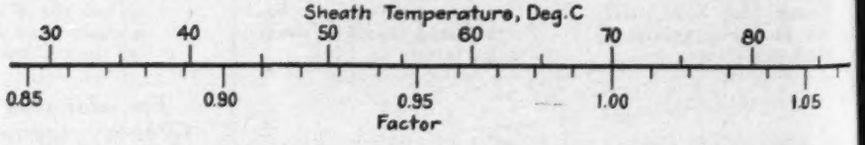
Use the conversion scale to obtain sheath resistance at a temperature other than 70 deg. C.—multiply value obtained from table by factor corresponding to desired sheath temperature.

Resistance values and conversion scale are based on the following:
Restivity of lead = 24.2 x 10^{-6} ohm-cm at 40 deg. C.
Temperature coefficient of lead = 0.0040 per deg. C.

LEAD SHEATH RESISTANCE
(10^{-4} ohms per foot per 70 deg. C.)

Outer Lead Diameter Inches	Lead Thickness - mils						
	94	101	105	109	125	133	141
1.0	4.79	4.49	4.34	4.19	3.73	3.54	3.37
1.1	4.31	4.04	3.90	3.77	3.34	3.17	3.02
1.2	3.92	3.67	3.54	3.42	3.03	2.87	2.73
1.3	3.60	3.36	3.25	3.14	2.78	2.62	2.50
1.4	3.32	3.11	3.00	2.90	2.56	2.42	2.30
1.5	3.08	2.88	2.78	2.69	2.37	2.24	2.13
1.6	2.88	2.70	2.60	2.51	2.21	2.07	1.980
1.7	2.70	2.52	2.44	2.35	2.07	1.957	1.858
1.8	2.54	2.38	2.29	2.21	1.947	1.839	1.74
1.9	2.40	2.24	2.16	2.08	1.838	1.733	1.643
2.0	2.28	2.12	2.05	1.978	1.740	1.641	1.554
2.1	2.16	2.02	1.945	1.878	1.651	1.558	1.475
2.2	2.06	1.922	1.852	1.789	1.571	1.481	1.402
2.3	1.963	1.835	1.769	1.708	1.500	1.412	1.338
2.4	1.879	1.756	1.691	1.631	1.433	1.350	1.279
2.5	1.800	1.682	1.621	1.562	1.372	1.293	1.226
2.6	1.729	1.617	1.557	1.501	1.318	1.241	1.175
2.7	1.662	1.553	1.498	1.442	1.268	1.192	1.129
2.8	1.600	1.496	1.440	1.390	1.220	1.148	1.088
2.9	1.542	1.442	1.390	1.340	1.178	1.107	1.048
3.0	1.490	1.392	1.340	1.292	1.134	1.068	1.011
3.1	1.440	1.347	1.297	1.250	1.097	1.032	0.977
3.2	1.395	1.302	1.253	1.210	1.061	0.999	0.945
3.3	1.351	1.262	1.215	1.171	1.027	0.967	0.915
3.4	1.310	1.223	1.178	1.138	0.996	0.938	0.887
3.5	1.272	1.188	1.142	1.103	0.966	0.910	0.860
3.6	1.237	1.153	1.110	1.072	0.939	0.884	0.836
3.7	1.201	1.121	1.080	1.042	0.912	0.859	0.813
3.8	1.169	1.091	1.051	1.013	0.888	0.835	0.790
3.9	1.138	1.062	1.022	0.986	0.865	0.814	0.769

CONVERSION SCALE



† See also *Electrical World*, June 24, 1944, page 104.

* Assistant Engineer, Consolidated Edison Co. of New York, Inc.

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KOLD-VOLT COLD CATHODE *for Industrial Lighting*

U.R.C. RESEARCH LUMINAIRE *for Commercial Lighting*

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Model No. 2032
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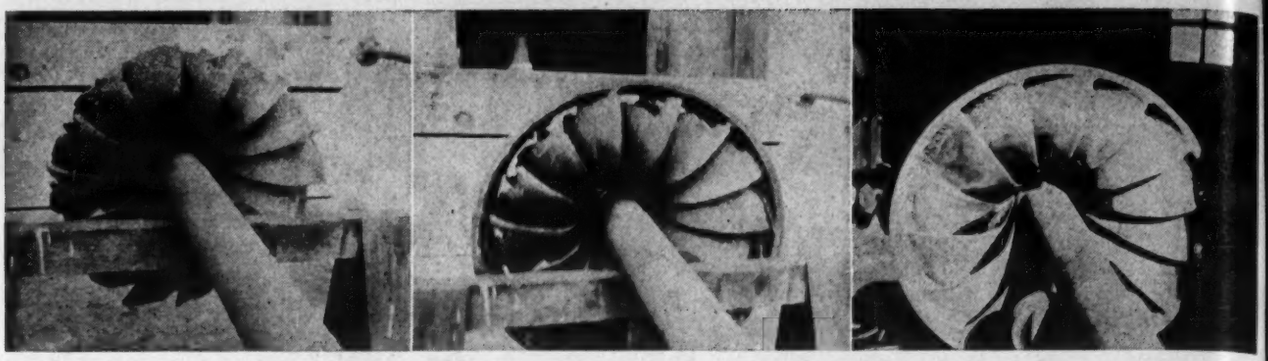


RUNNER eaten away by acid-bearing water (left), with ring removed (center) and restored to usable condition by welding (right)

Welding Restores Corroded Water Wheels

What can be done by skillful use of modern welding methods is strikingly shown in the accompanying series of pictures of an 18-in. turbine runner removed from one of the small hydro plants on the system of the Appalachian Electric Power Co. The streams on which several of these plants are located carry acid wastes from chemical plants that, as is seen in the pictures, are quite corrosive.

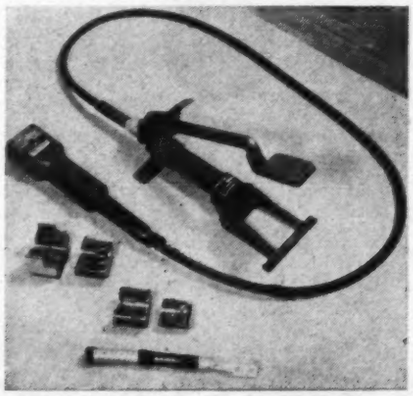
The blades are built back to shape and size with iron and then are faced with stainless steel. The running speeds of these wheels are not high and a perfectly satisfactory job of balancing the repaired runner can be done in the shop. The cost of repair is about one fifth of the cost of a new wheel. The availability of new equipment did not enter the problem.

Chamber for Testing Water-Tight Joints

By W. F. BONWITT
Chief Research Engineer
Burndy Engineering Co., Inc.

To test the finished installation of a new water-tight cablelug connection, a special hydrostatic test chamber was designed. While all parts are of standard design, easily interchangeable, an unusual detail is to be found in the stuffing box through which the cable extends to the outside.

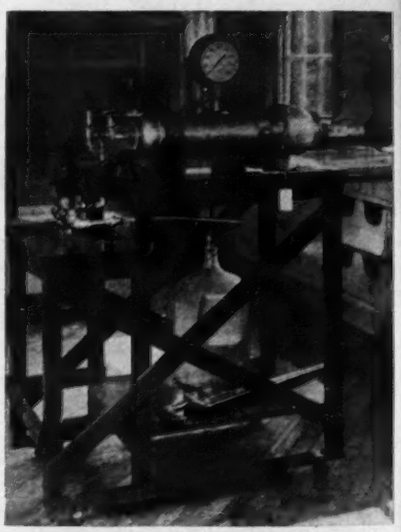
The stuffing box is made of three plates; the outer two are of steel and the center one is of rubber. No wicking or cement is needed and no damage is done to the insulation. By using sets of plates with openings of different diameters, the range of cable sizes which the chamber can accommodate is practically unlimited.



HYPRESS with interchangeable Dual dies for producing water-tight connections. In the foreground is a Hysealug installed on a cable

Use is best explained by a description of test procedure. The assembly to be tested (consisting of a Hysealug installed on a length of cable) is placed in the test chamber as shown in the figure. The chamber is sealed around the cable by means of the stuffing box. The Hysealug is anchored to the chamber structure in order to prevent a sliding motion when pressure is applied. The overflow-valve is opened along with the main-intake-valve, while the drain-and-air valves are closed.

The water is pumped from the tank into the chamber until it is filled and the overflow-valve is closed; any further operation of the pump will increase the hydrostatic pressure in the chamber. Pressure can be maintained indefinitely by closing the intake-valve. The pressure is increased in steps and each value maintained for a definite period. If the seal between the cable insulation and the shroud should be defective water would be forced inside the Hysealug and then would travel through the interstices of the conductor strands to the open end of the cable where it would leak out. Connections similar to that shown have withstood pressure of more than 500 psi. without leakage.



HYDROSTATIC Chamber used in testing water-tight joint between connector and cable as set up at the Burndy plant

The seal is made by the compression of the tubular shroud on the cable insulation by a hydraulic actuated Hypress using Dual dies. This indents the connector onto the conductor for the electrical connection,

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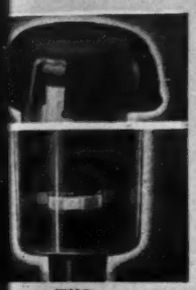
That's Why L-M Lightning Arresters Provide Better Protection . . . Require Less Replacement . . . Lower Arrester Costs

The protection a lightning arrester will provide . . . the years over which it will handle light and heavy surges depend upon the way it is designed and built....L-M Lightning Arresters are outstanding in this respect. Failures in the field are negligible. Their ability to stand up for years means less expense for you.

NO OTHER ARRESTER CONSTRUCTION LIKE THIS

ONE

1. This illustration shows the glass housing with the characteristic element *molded* into the glass, not just poured or placed in. The copper contact surface, also illustrated, is applied in the molten state under pressure and becomes an integral part of the characteristic element. Due to war, porcelain housings are being temporarily used for part of our production.

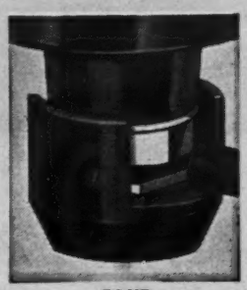


TWO

2. In addition to the employment of 4 separate gaskets, L-M Lightning Arresters are further sealed with a strong, weatherproof sealing compound which completely seals in both the top and bottom of arrester. Two separate tests for moisture are made. No lightning arrester on the market is more moistureproof.

THREE

3. This shows assembly of the ladder spark gap which is made of heavy brass bar—not stampings—machined to 7/16" diameter; the upper electrode; the synthetic rubber sealing gasket; and the copper cap which is spun to the housing under pressure. This entire assembly constitutes one compact moistureproof unit.



FOUR

4. The L-M Isolator is a patented feature. In addition to identifying a damaged arrester, it disconnects a faulty arrester from the line to prevent grounding of phase or circuit.

Study the design and construction of L-M Lightning Arresters. Talk to the Line Material man. Ask him questions: Send for Bulletin 40151 for more detailed explanation than this advertisement contains. A little thought and investigation on your part will bring you to the conclusion that you can save your company a consistent amount of money over the years by standardizing on L-M Lightning Arresters. Line Material Company, Milwaukee, Wis.

***THE ISOLATOR**
AN EXCLUSIVE L-M FEATURE
PAT. NO. 2,315,320

ETS THE NEW NEMA STANDARDS

ge three Oscillogram photos show how M Lightning Arresters meet the new MA standards. Fig. 1 shows operation racteristics before 5,000 ampere oper- g cycle test of a 3 Kv Arrester. Fig. 2 ws characteristics after the 30th shot. 3 shows the unchanged characteristics r single 65,000 ampere surge as re- ed by new NEMA standards.

Fig. 1 Fig. 2 Fig. 3

SIZES—L-M Lightning Arresters are made in 6 sizes with ratings ranging from 1 to 15 Kv.

STANDARDS—All L-M Lightning Arresters meet the new NEMA standards. In repeated tests L-M Lightning Arresters maintain uniform performance characteristics.

LINE MATERIAL
LIGHTNING ARRESTERS

L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers · Fuse Cutouts and Fuse Links · Lightning Arresters · Oil Switches · Pole Line Hardware · Line Construction Specialties · Underground Equipment · Fibre Conduit · Street Lighting Equipment

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The gearmotor combines prime mover and speed reducer in a single compact unit. It eliminates the long center-to-center distances of belt drives . . . the space-consuming arrangement of open gearing . . . and the extra floor area required by a separate speed reducer. You can fit a gearmotor up *tight* against the driven machine.

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10 GOOD REASONS FOR USING WESTINGHOUSE GEARMOTORS

1. FEWER PARTS TO WEAR. The simple, efficient design uses a minimum of moving parts.

2. BPT "TOUGH-HARD" GEARS AND PINIONS. This exclusive Westinghouse heat-treating method "tough-hardens" teeth for maximum resistance to shock and impact—means longer wear.

3. USE ALL WESTINGHOUSE MOTOR TYPES—open ::: totally-enclosed . . . splashproof . . . explosion-proof —to help meet changes in operating conditions quickly and easily.

4. INTERCHANGEABILITY OF PARTS between unit types reduces your parts' replacement stock by 40%.

5. HIGH EFFICIENCY of gearing parts assures full motor horsepower at output shaft . . : only 2% power loss per gear set.

6. POSITIVE LUBRICATION of gears and bearings by automatic splash system reduces probable maintenance to twice-a-year change of oil.

7. EASY ACCESSIBILITY. Gearing parts can be readily inspected or easily removed to effect gear ratio changes.

8. IMPROVED FOUNDATION STABILITY. Feet are under the gear case : : : placing support next to the gearmotor load. Each foot is reinforced by external ribs.

9. UNIT RESPONSIBILITY for design : : : manufacture . . . and service. Westinghouse builds both the motor and the gears.

10. MEET A.G.M.A. STANDARDS. The new Westinghouse Gearmotors are specifically designed and built to meet A.G.M.A. standards . . : easy to order and match to the job.

Gearmotors

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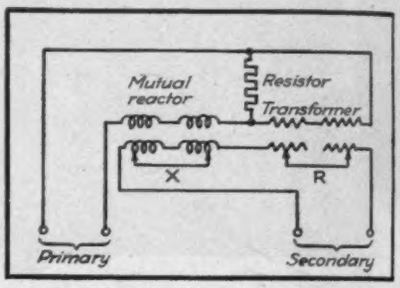
and compresses the shroud on the insulation for water-sealing. This type of joint is of great importance at the present time for shipboard installation. Wide future application can be foreseen in the utility and industrial field in protecting the conductor against liquids and gases.

•

Compensators For Distance Relaying—I

By J. L. BLACKBURN
Relay Engineer Westinghouse Electric & Manufacturing Co., Newark, N. J.

Transmision lines with a transformer bank as a part of the line (or that terminate in a high voltage bus) do not always have a source of high voltage potential. For distance-type protective relaying, high voltage or line-side potential (or its equivalent) is necessary unless the relays can be

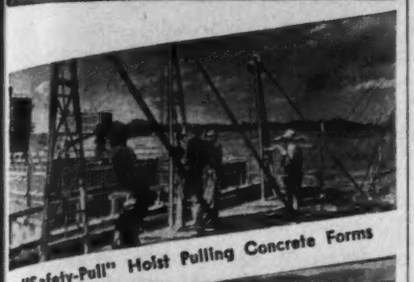


SCHEMATIC diagram of compensator, known as type KX, used with low voltage potential transformers to energize distance type relays

set through the transformer bank, since these relays operate on a ratio of voltage to current.

This ratio is electrical distance (impedance or reactance) and normally is measured from the point on the system where the relay potential is obtained, provided current is flowing through this point. Consequently, low voltage potential is not satisfactory for distance relaying unless the power transformer can be included as part of the protected line impedance or reactance, or unless there is no fault power flow through the power transformer. When these two conditions are not fulfilled, a device is needed that reduces or compensates the low voltage potential transformer voltage by the equivalent drop through the power transformer for high voltage line faults. The compensator is such a device. It makes it possible to use available low voltage

COFFING HOISTS



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"Quik-Lift" Electric Hoist Speedily Moving Pipe

Model "YC" Spur Geared Hoist Moving Large Truck Motor

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IN PRACTICALLY ALL LINES OF INDUSTRY COFFING HOISTS ARE PLAYING A PROMINENT PART IN SPEEDING UP
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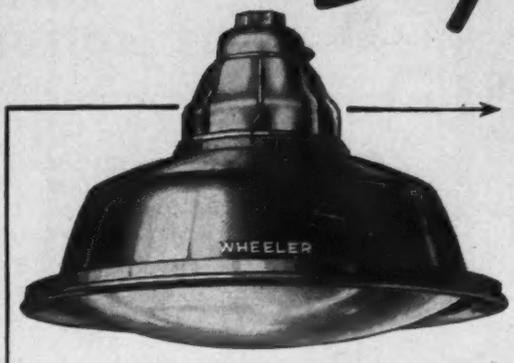
Here's *Skilled Lighting*



Wheeler Vapolux Fixtures. Made in standard styles for 100 to 500 watt lamps. All joints dust-tight. Scientifically balanced heat dissipation. High light output.

Wheeler Globe-Type Fixtures. Dust-tight and vapor-proof. Made in standard styles for 75 to 200 watt lamps. Same high safety and lighting standards as Vapolux unit.

for Class II, Group G Locations!

In lighting fixtures for hazardous locations, the advantages of Wheeler "Skilled Lighting" show up even more outstandingly than in more common types of reflectors.

Wheeler Vapolux and Globe-Type Fixtures comply with all requirements necessary or desirable in class II-G locations. Also, they give you the high measure of light output, durability and ease of installation and maintenance that can only come from better engineering, backed by long experience. In every detail, Wheeler Lighting is "Skilled Lighting" developed with the experience of over 62 years' specialization!

Write for complete Catalog 50 containing full details of these high-efficiency, high-convenience units for Class II, Group G locations. **Wheeler Reflector Company, 275 Congress St., Boston 10, Mass.** . . . New York City. Representatives in principal cities.

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Hallicrafters will give $100.00 for the best letter received during each of the five months of April, May, June, July and August. (Deadline: Received by midnight, the last day of each month.) . . . For every serious letter received Hallicrafters will send $1.00 so even if you do not win a big prize your time will not be in vain. . . . Your letter will become the property of Hallicrafters and they will have the right to reproduce it in a Hallicrafters advertisement. Write as many letters as you wish. V-mail letters will do. Military regulations prohibit the publication of winners' names and photos at present . . . monthly winners will be notified immediately upon judging.

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THE HALLICRAFTERS CO., MANUFACTURERS OF RADIO AND ELECTRONIC EQUIPMENT, CHICAGO 16, U. S. A.

potential transformers to energize distance type relays.

The compensators are required with low voltage potential transformers only if there is current flowing through the power transformer to the fault on the high voltage line. If this current is zero or negligible, indicating a load on the power transformer, then the high and low potential transformer magnitudes are essentially equal and the low voltage potential is satisfactory for distance relaying on the high voltage line. The distance seen by the relay would be that between the fault and the high voltage bus. This and the following discussion assumes that voltage drop produced by load current is negligible compared to the fault voltage drops.

A typical compensator is shown in the accompanying diagram. The mutual reactor, used to provide the reactance compensation, has air gaps in its magnetic circuit so that the magnetizing current is large. Consequently, the voltage induced in the secondary winding is approximately 90 deg. out of phase with the primary current.

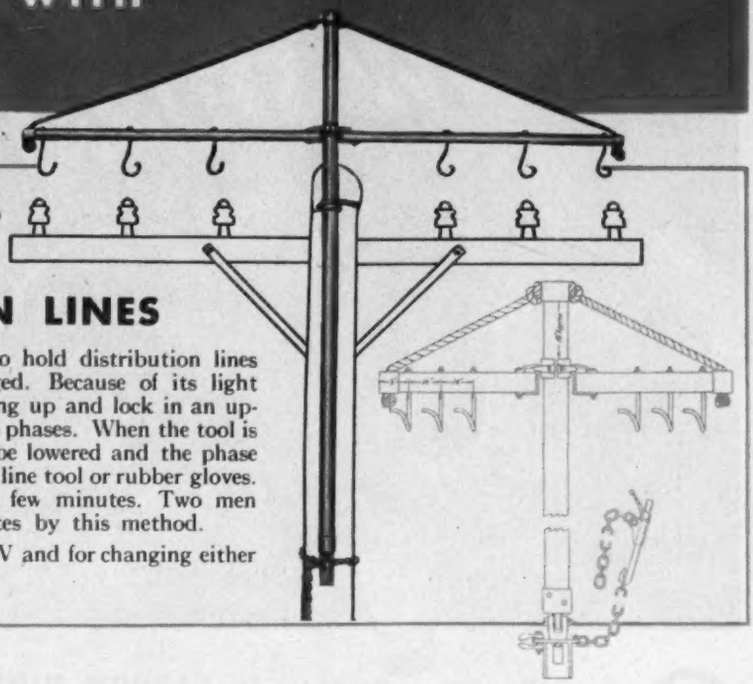
Transformer Function

Resistance compensation is provided by the transformer and resistor. The transformer primary is connected across the resistor so that the secondary voltage output of transformers is proportional to and in phase with the drop across the resistor.

The secondary voltage windings of the compensator are provided with a number of taps. By properly adjusting these taps the voltage produced across the secondary terminals by current flowing between the primary terminals is proportional to and in phase with the drop in the transformer. Under these conditions the ratio between R and X in the compensator is the same as the ratio between R and X in the power transformer. Setting the compensator is merely the process of reducing the R and X of the power transformer to their equivalent values in terms of the secondary voltage base of the low voltage potential transformers. This requires that the potential and current transformer connections and ratios and the connections of the power transformer be known as well as the R and X values of the power transformers.

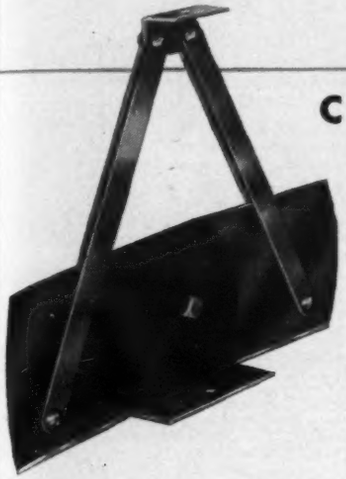
Helpful suggestions on line construction and maintenance with CHANCE equipment

THIS TEMPORARY CROSS-ARM SIMPLIFIES REPAIR WORK ON DISTRIBUTION LINES

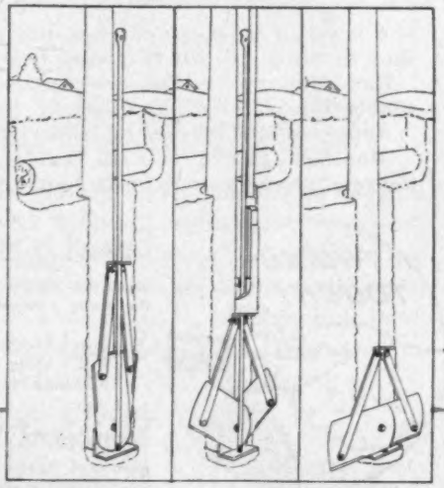


This temporary distribution crossarm is used to hold distribution lines above the regular crossarm while it is being changed. Because of its light weight and the folding feature of the arms which swing up and lock in an upright position, this device is easily lifted up between the phases. When the tool is in position and clamped to the pole, the arms may be lowered and the phase wires lifted into the hooks provided, by means of a hot line tool or rubber gloves. The damaged crossarm may then be changed in a few minutes. Two men have averaged changing one arm every seven minutes by this method.

The tool is designed for use on voltages up to 4KV and for changing either four or six pin arms. Send for complete details.



CHANCE EXPANDING POLE KEYS SAVE MANPOWER



Here is a peace time product that will help you to keep pole lines erect and to save many man hours that would otherwise be required to install the old type wooden keys. In many instances, Chance Pole Keys will take the place of guy anchors when they are not available. Chance pole keys are available for prompt shipment from stock.

Actually, this is an expansion anchor which expands into solid earth at the base of the pole. One of these anchors may be installed in approximately 15 minutes. The sketches at right show the method of installation.

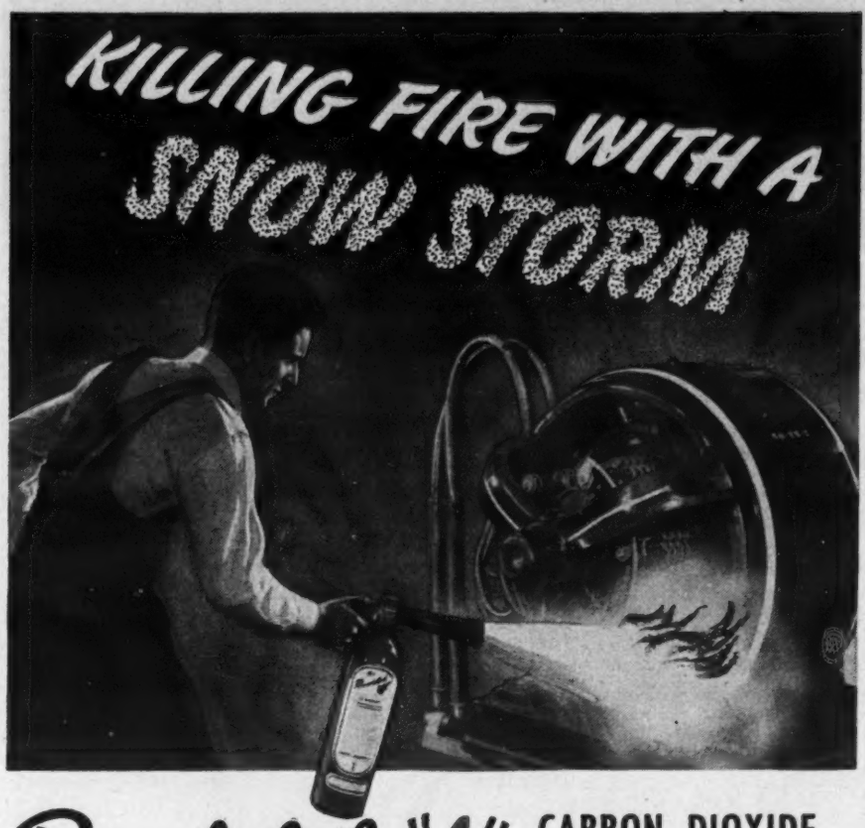
DISCONNECT TOOL WITH SPRING HAMMER ACTION FOR STUBBORN CUTOUTS AND DISCONNECT SWITCHES

The spring action in this disconnect tool, which attaches to a universal hot line stick, permits the user to deliver a hammer blow to the pulling ring on stubborn cutouts and disconnects, which have become corroded. Linemen praise this tool because it can be used at various angles and the hammer action eliminates the need for straining and the danger of becoming unbalanced.

CONSULT YOUR CHANCE & TIPS TOOL CATALOGS

A·B·CHANCE CO·
CENTRALIA, MISSOURI.

ABC INDUSTRIES



Randolph "4" CARBON DIOXIDE FIRE EXTINGUISHER

A startled worker snatches the *nearest* extinguisher. No time *now* to think . . . hit the blaze *before* it does damage!

Randolph "4" *simplifies*—speeds fire fighting. Smothers flammable liquid, electric, machine fires with instant, easy action. Approved and labeled by Underwriters' Laboratories, Inc.

***Mobilize* against fire with Randolph carbon dioxide. For prompt delivery phone your supply house or write us—today.**

Easy! So obvious and easy . . . any employee can use it. No valves to twist or horns to raise. Just touch the trigger . . . and powerful carbon dioxide smothers the fire in a penetrating, icy blanket!

Safe! Randolph carbon dioxide does not conduct electricity or damage equipment. Dry and odorless . . . it disappears after the fire is out. Does a neat job!

Efficient! Carbon dioxide will not deteriorate. It remains effective even in extreme temperatures. Keeps maintenance at a minimum . . . eliminates annual refilling problem.

Randolph "2" Ready to combat sudden "flash" fires. This compact, small unit with exclusive Randolph design, is especially adapted for BUSES, TRUCKS, MARINE CRAFT. Ideal, instant protection for HOTELS, HOSPITALS, INDUSTRIAL KITCHENS.

SEND NOW *for free booklet "Sharpshooting at Flames." Illustrates latest techniques in carbon dioxide fire fighting.* NAME_____

ADDRESS_____

RANDOLPH LABORATORIES *INC.*

8 EAST KINZIE ST., CHICAGO 11, ILLINOIS

Applications of the compensator will be presented in subsequent articles.

•

Orders, Records, Location—In a Jiffy

By K. M. NORCROSS,
Superintendent
and J. E. ROBERTS,
Manager
Sherrard Power System
Orion, Ill.

A new form has been devised by the Sherrard Power System to locate in an exceedingly short time all work orders on a particular new rural customer connection. This plus the correct location, address and materials used have avoided many verbal mistakes.

This form is filled out by the rural

NEW SERVICE DATA 112

Name John Farmer

Length of line 0.25

Location, (If necessary attach drawing).

Section 5 Township Mercer County Henry

Indicate location of new customer Thus O

And nearest existing customer Thus ●

#939

Connection authorized by WPB:

Order U-1-C ✓ Letter dated ____ Other ____

Remarks: Contract 2

Load customer expects to connect:

Household Appliances and 3 H.P. motor

Does he require or desire 3-wire 240v service? Yes

This account is to be in the name of:

John Farmer

Property owner X Tenant ____

What is the address to which future bills are to be mailed?

Pleasantville - R.F.D. #4

Date 9-16-43 By A.G.

The items below are to be filled in by superintendent.

Base left Yes or Enclosure left ____ Staked 9-23-43

WO No. 67432 for Poles and Fixtures

WO No. 67433 for Primary Conductors

WO No. 67434 for Transformer and Service

WO No. 67500 for Meter

Completed 10-2- 1943

Remarks: Will be new acct #838A

NEW SERVICE data form with all the necessary information on location, construction, clearance, and billing

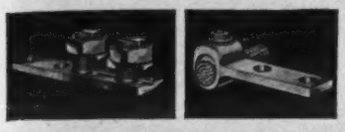
representative with information supplied by the prospective customer. The copy then goes to the superintendent of distribution who fills in the bottom portion. When the job is completed the original is returned to the office for filing. Jobs are usually done in the order in which they are received. Thus, the number at the top right designates who next should receive service.

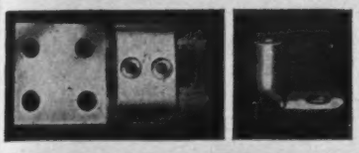
(This article may be considered as a sequel to that by K. M. Norcross on "Locating Customers on Rural Lines," ELECTRICAL WORLD 7-25-42 page 86.)

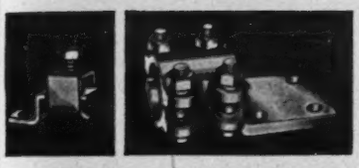
"To get the **RIGHT** lug at every point—

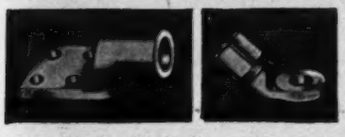
—select your terminals from the **COMPLETE** line"

Look in the Penn-Union Catalog—all of the good types: Solderless lugs to grip the conductor by Bolt, Screw, Post-and-Nut, or Multi-Slit Tapered Sleeve . . . Soldering lugs, Cast and Stamped, in wide variety . . . Here are just a few:









You will also find the most complete line of Cable Taps, Tee Connectors . . . Straight, Parallel, Elbow and Cross Connectors . . . Bus Supports, Clamps, Spacers . . . Grounding Clamps, Service Connectors.

Penn-Union fittings are preferred because every one is mechanically and electrically *dependable*. They are the first choice of leading utilities, industrials, electrical manufacturers, contractors. *Write for the Penn-Union Catalog.*

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

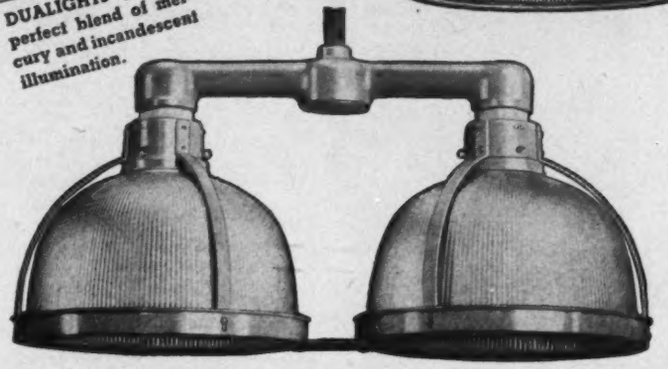
PENN-UNION
Conductor Fittings

PITTSBURGH *Permaflector* INDUSTRIAL UNITS

E-530-B PERMAFLECTOR not housed.

I-1005-N with retaining ring.

D-530-N DUALIGHTS provide perfect blend of mercury and incandescent illumination.



Permaflector silvered-glass units provide highly efficient, engineered light control for every industrial lighting requirement . . . general or localized . . . ceiling or sidewall installation . . . high or low bay mounting . . . for medium, broad, or concentrated distribution . . . for lamp wattages of 100 to 1,500 watts . . . with incandescent, mercury vapor lamps, or a combination of both . . . mounted as single units or on dual hangers. Sold on priority thru Electrical Wholesalers.

FLOODLIGHTS

Rugged in construction · weather-proofed and corrosion-resistant · equipped with famous silver-mirrored glass Permaflectors. Available in 200 to 1,000 wattages, and broad, intermediate or concentrated light distributions. Complete. Ready to set up.

PITTSBURGH REFLECTOR CO.
OLIVER BLDG., PITTSBURGH, PA.

ILLUMINATING ENGINEERS DESIGNERS & MANUFACTURERS of COMMERCIAL & INDUSTRIAL LIGHTING EQUIPMENT

• Now producing confidential lighting equipment for the Armed Forces and supplying Industrial users on priority (Commercial replacements from stock). Startling new post-war developements now in work will soon be announced.

NEW EQUIPMENT

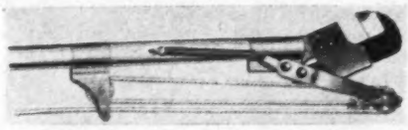
Outdoor A.C. Welder

Type WK-15; 60 C; 300 amp.; 220/440 to 75 v. **General Electric Co.**, Schenectady, N. Y.

Outdoor a.c. welder designed for locations where weather exposure is common. Provided with "idlematic" control. Protection against rain, snow and sleet is said to be provided by drip proof construction of openings and by sealed window over current indicator.

•

Tree Trimmer



No. 900 Tree trimmer; 7¼ lbs.; pole two 5 ft. sections; joints self locking; **Newman Manufacturing Co., Inc.**, 1636 Central St., Kansas City, Mo.

The trimmer is composed of a cutting head actuated by a pulley rope. It is stated leverage allows cutting 1½ in. limb. Cutting blade is made of chrome-carbon tempered steel; head is of carbon alloys. A ½-in. anvil base holds the tool in alignment with the limb removing side stress on the cutter. Elimination of pole stress, minimizes breakage.

Wick Feed Oilers

Plastic reservoir; capacity 1, 2 and 4 oz.; reinforced ribs; pipe threads ⅛, ¼ and ⅜; metal base; **Trico Fuse Mfg. Co.**, Milwaukee, Wis.

Type LA, LB, LC and LD all have reinforced plastic bottles but differ in lever shut-off and sight feed combinations. Usable in temperatures up to 170 deg. F.

•

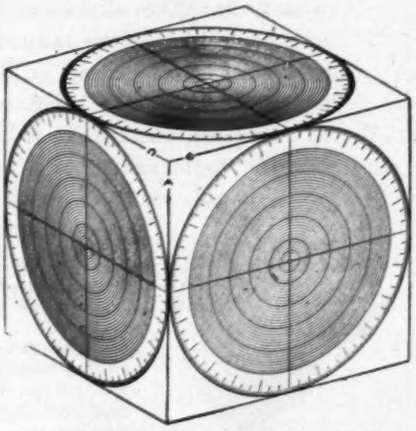
Current Collector

Silver and silver alloys; **Gibson Electric Co.**, Frankstown Ave., Pittsburgh 21, Penn.

Commutator segments of various shapes and sizes can be supplied from silver alloys. Reported to retain hardness and wearing qualities of silver and alloys. Reported usable for commutator bars, collector rings, motor brushes and sliding contacts.

•

Trimetric Underlay



Trimetric underlay: drawing instrument; **Glenn L. Martin Co.**, Baltimore 3, Md.

Designed for construction of ellipses. Consists of trimetric cube with concentric ellipses arranged eight to an inch on each of the three planes. The outer being graduated in degrees.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Tester

RCP Pocket Model 420; size 6⅜ in. x. 3½ in. x 3 in., wt. 25 oz.; **Radio City Products, Inc.**, 127 W. 26th St., New York 1, N. Y.

Meter movements reported to be accurate within two percent. Voltage multipliers stated to be metallized matched pair resistors having a metallized tolerance of one percent. Basic meter is given as 0.400 μa. DB meter, output meter, milliameter and ohmmeter are reported to provide 23 ranges. Supplied in hardwood case complete with batteries.

•

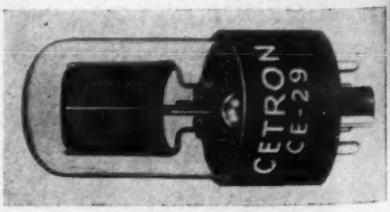
Air Sander

Mity-Midget Air Sander; 50 lbs. air pressure; wt. 3½ lbs.; 5½ in. long; 4¼ in. high; **National Air Sander, Inc.**, Rockford, Ill.

An air operated motor development for wet or dry sanding. Sanding pad moves in a circular motion so that each grain of sand scribes a $\frac{3}{16}$ in. circle at 5,000 cycles per minute. Motor reported sealed by synthetic rubber housing.

•

Phototube



Type CE 29 phototube: blue sensitive. **Continental Electric Co.**, Geneva, Ill.

Blue sensitive phototube using an octal five-pin base. Reported useful with light sources rich in violet, blue or green and not sensitive to red or infra-red.

HUBBARD AUTOGAPS *Rain or Shine!*

Hubbard Autogaps are absolutely unaffected by moisture. Exhaust ports are designed so that rain cannot enter. The all-important fibre valve element is also unaffected by moisture content in the air or actual wetness. Due to these planned characteristics there is no need for sealing Hubbard Autogaps and relying on the permanence of the seal.

Inquiry indicates that engineers have shown greatest interest in the elimination of moisture from lightning arresters and consequent faulty operation. Rain or shine, use Hubbard Autogaps!

HUBBARD AND COMPANY

PITTSBURGH . . . OAKLAND CALIFORNIA . . . CHICAGO

LOOK FOR THIS

T-K *Symbol of Service*

GET acquainted with the T-K Symbol of Service! It serves as a dependable buying guide for the trade and the consumer towards all that is newest and best in Electric Range Heating Units. You'll see it with ever-increasing regularity on many of America's finest ranges. It's to your profit and advantage to feature electric ranges equipped with T-K Heating Units. And for the greater satisfaction of your customers, sell them T-K Replacement Units. They'll give faster, more economical service for a long time. The majority of America's Electric Range Manufacturers use T-Ks. Get all the details today!

TUTTLE & KIFT INC.

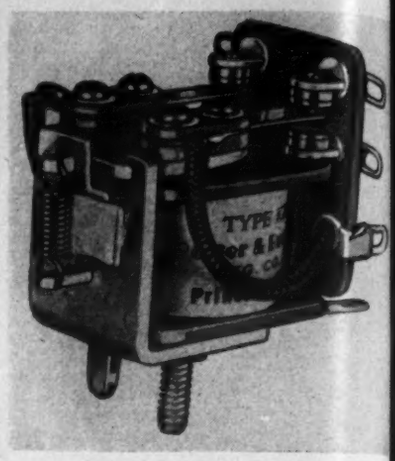
GENERAL OFFICES AND PLANT

1825 NORTH MONITOR AVENUE • CHICAGO 39, ILLINOIS

Engineers and Manufacturers of:

ELECTRIC RANGE UNITS • WATER HEATER UNITS • INDUSTRIAL HEATING UNITS • HEAT CONTROLS • SWITCHES AND SELECTORS

Relay



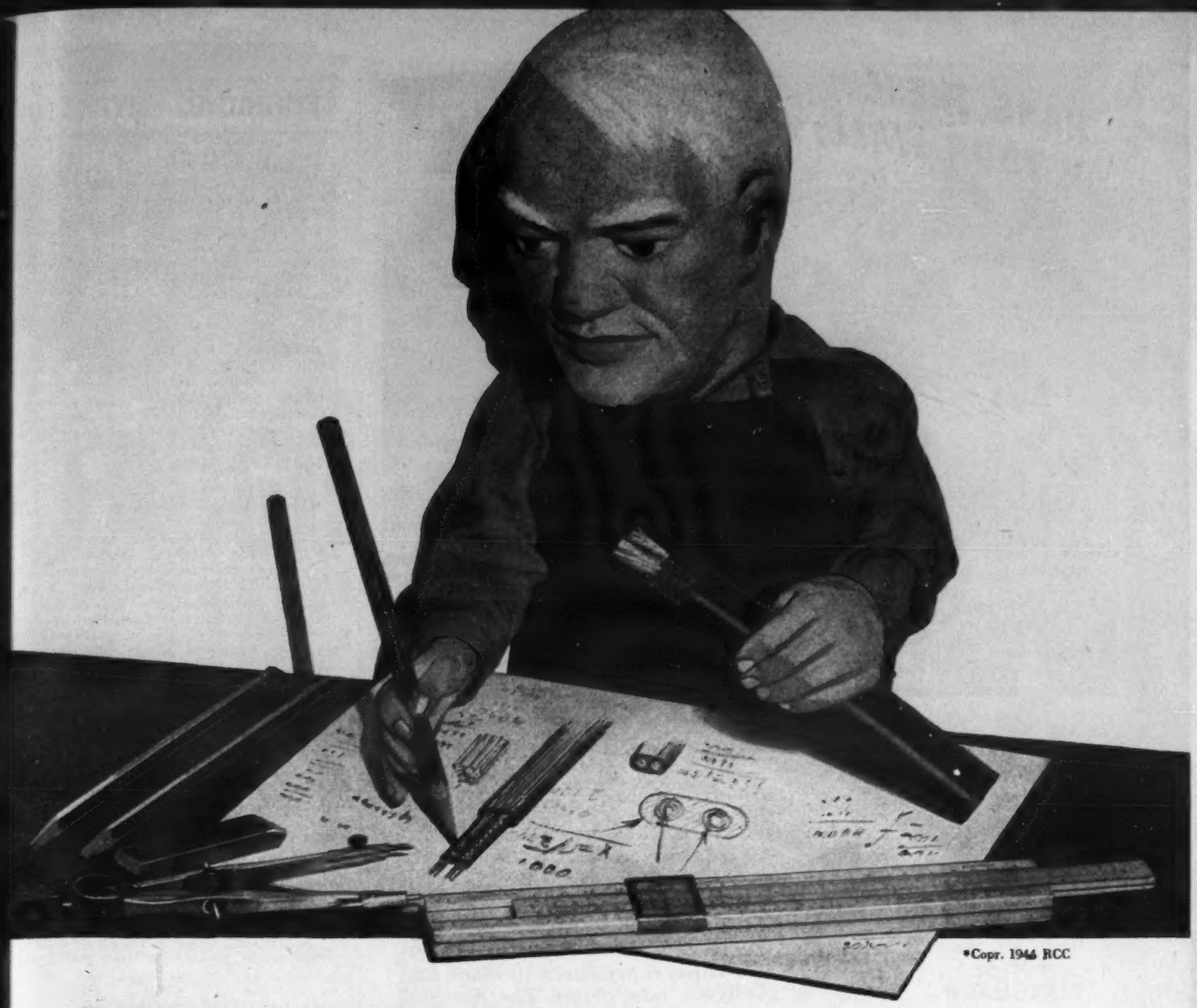
KR Series relays; 3 amps; 110 v. 60 C non-inductive; silver contacts: wt. 2 oz., 1 3/16 in. wide x 1 1/16 in. long x 1¼ in. high; **Potter & Brumfield Mfg. Co., Inc.,** Princeton, Ind.

Applicable where size and weight are important factors. Where operating currents are not too limited, the d.c. types are reported adjustable to withstand vibration similar to that in aircraft. Reported to be provided with a mechanism which provides adjustment of armature spring.

Tubes

RCA-9C22 and 9C21; multi-strand, single-phase tungsten filament; frequencies at capacity 5 mc., at reduced ratings up to 25 mc.; **Radio Corporation of America,** Camden, N. J.

Tube 9C22 forced-air-cooled weighing 235 lb. measuring 25 inches in height. Pair, operated as unmodulated Class C oscillators, reported to have a tube output of 130 kw. maximum. 9C21 water-cooled operated under same conditions said to furnish up to 200 kw. Both are reported to have an entrant metal header providing a short internal connection between filament and filament terminals.



*Copr. 1946 RCC

"We're on the Job for the Future"—says *Rōmey

"Up here at Rome Cable," says Romey, "we're doing our best to keep up with the heavy load of war orders. We're working day and night on a production schedule that's full of special wire and cable products for very special uses connected with the war effort.

"But we're not neglecting the future—not by a long shot. Ever since the war started, we've been constantly at work designing new insulating compounds and new products, and developing new methods of making them.

"Our wartime experience is going to enable us to serve your future wire and cable needs even better than we've served you in the past."

FROM BAR TO FINISHED WIRE

ROME CABLE
CORPORATION
ROME • NEW YORK

HANG THESE ON YOUR WALL: this famous fire

this famous fire fighter

S.O.S. FIREGUARD 1 qt. size

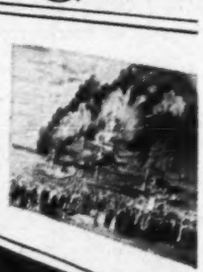
Hundreds of the world's most precious art treasures were destroyed within 30 minutes when flames engulfed the New York Crystal Palace on October 5, 1858. As an event of world-wide interest this historic fire was illustrated by Currier & Ives, renowned print makers. A free copy, reproduced in black and white, is available now from The General Detroit Corporation. Ideal size for framing. Limited supply. Send coupon *today!*

If it's GENERAL DETROIT it's better

S.O.S. FIRE GUARD is a quick, efficient, "on-the-spot" fire fighter. Handy 1 or 1½ qt. sizes for car, truck, boat, airplane, home or plant. Instantly extinguishes flame . . . guards against post-ignition hazards . . . S.O.S. FIRE GUARD is a vaporizing liquid (C.T.C.) type extinguisher, recommended for electrical, gasoline, oil, and similar fires. Quality mass produced for essential users by General Detroit, makers of Alaskan, Floafome, and CO/Fog. Prompt delivery.

THE GENERAL DETROIT CORP.

Former name The General Fire Truck Corp.
NEW YORK DETROIT CHICAGO
Distributors in all principal cities
West Coast Affiliate: The General Pacific Corp., Seattle, Los Angeles, San Francisco.



THE GENERAL DETROIT CORP.
2200 East Jefferson Ave., Detroit 7, Michigan

Send free copy of the "Crystal Palace" fire.

Name _____

Title _____

Attach this convenient coupon to your letterhead and mail. (500)

TECHNICAL LITERATURE

Capacitors—A 20 page booklet (No. 4225) entitled "Engineering Aspects of Pyranol Capacitors in Large Banks" which covers (1) basic principles of system kvar. requirements and supply, (2) application requirements of kvar. sources, (3) installations and equipment, and (4) application problems. Copies may be had gratis from General Electric Co., Schenectady, N. Y.

Condensed Catalog—No. 441 giving basic information, dimensions, etc., on safety switches, light and power panelboards, switchboards, circuit breaker panelboards, kbl-duct and Busdistribution duct may be procured from Bulldog Electric Products Co., 7610 Jos. Campau Ave., Detroit, Mich.

Gas Cutting Guide—A pocket-sized slide-type guide that shows the proper tip sizes, gas pressures, and other data required for machine gas-cutting steel of various thicknesses. By setting the slide to one of the known factors (such as steel thickness) the gas-cutting machine operator may immediately determine the correct tip size, oxygen and acetylene pressure required, estimate gas consumption, width of kerf, and average cutting speed to be expected. Guide may be obtained free from Air Reduction Co., Inc., 60 E. 42nd St., New York 17, N. Y.

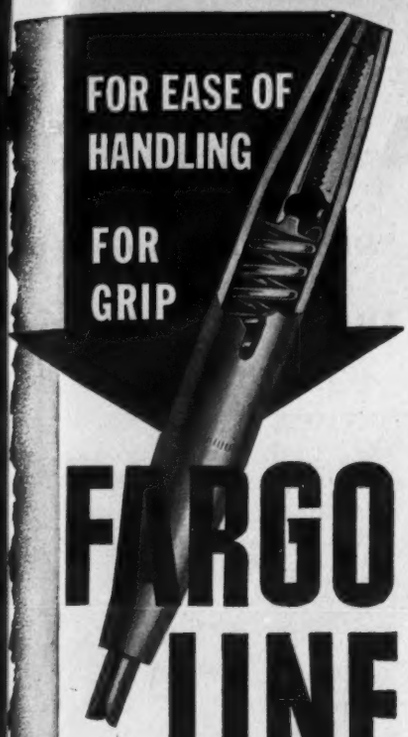
Formica—An illustrated booklet of 12 pages entitled "What Formica Is" describes in detail the material, grades, types and properties of the material. Copies may be obtained from The Formica Insulation Co., Cincinnati, Ohio.

Preserving Records—A bulletin "Hold Everything" issued by Microcopy Corp., 2800 West Olive Ave., Burbank, Calif., describes an application of microfilming to pencil engineering drawings made on transparent paper, as well as valuable records, documents, maps, etc., for preserving and safe keeping. Demonstrates advantages and document-insurance of the microfilming process.

Terminal Markings for Electrical Apparatus—number C6.1–1944, 44-page booklet approved by ASA on January 26, 1944. A system of connections and markings for terminals for electrical equipment, including generators, motors, converters, transformers, and power control apparatus together with the auxiliaries ordinarily furnished with such apparatus. National Electrical Manufacturers Association, 155 East 44th Street, New York 17, N. Y. or American Standards Association, 29 West 39th Street, New York 18, N. Y. Price $1.

Standards—"N.E.M.A. Lighting Arrester Standards," Publication No. 44-40. Price $1. National Electrical Manufacturers Association, 155 East 44th St., New York 17, N. Y. Covers a.c. valve types for station line, distribution and secondary service; protector tube type for transmission and distribution; also d.c. types for railway cars, trolley buses, feeder circuits and for secondary circuits. Also listed are gaps, capacitors and resistors for lightning protection.

Plastics—"Design and Fabrication of Laminated and Molded Phenolic Plastics and Vulcanized Fibre Parts" is bulletin FP43 issued by the Continental Diamond Fibre Co., Newark 15, Delaware, which illustrates and describes the shearing, sawing, punching, turning, milling, drilling and reaming of plastics and fibre sheets. Also included are tables treating the speed of machining and the tolerances obtainable. Copies may be had by addressing the Advertising Manager.

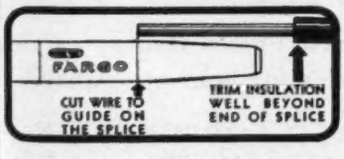


FARGO LINE SPLICE

Four separate jaws inside the Fargo splice provide a perfect "fit" around the wire; each jaw bites into the wire with a grip that won't let go. All copper shell, Everdur jaws and phosphor bronze spring insure the durability of this greater Fargo gripping power.

Convenient too. Sag Guide shows you how much wire goes inside the splice, tells you in advance the sag the line will have after splicing . . . side holes in the shell admit a screw driver tip for quick release of conductors.

Next time, splice with Fargo.



Made by FARGO MFG. CO.

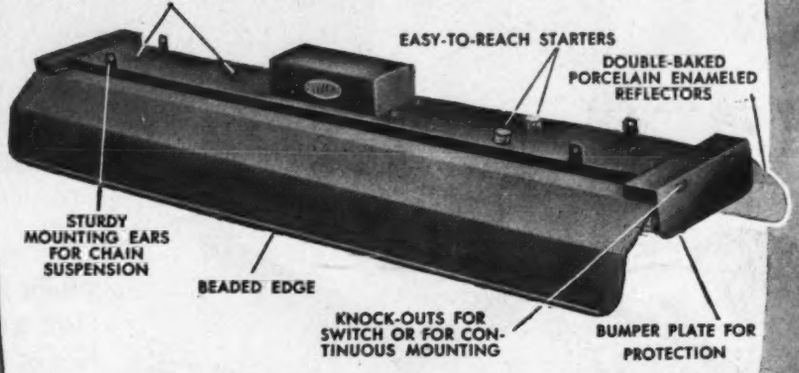
Distributed by

LINE MATERIAL CO.
MILWAUKEE • WISCONSIN

8* 7 vital reasons to specify

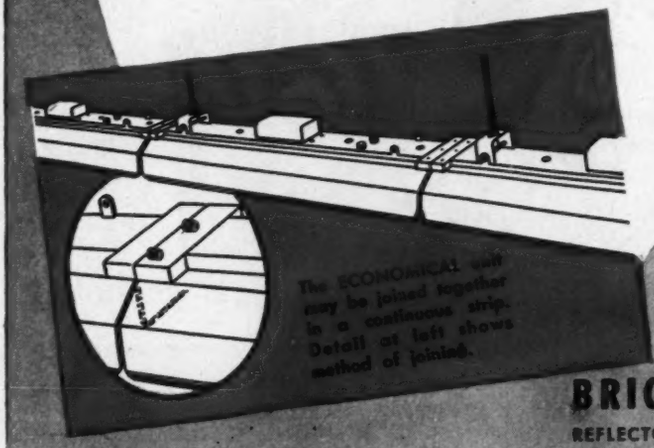
SILV-A-KING
LIGHTING EQUIPMENT

ECONOMICAL
FLUORESCENT INDUSTRIAL UNIT


CONVENIENTLY LOCATED KNOCK-OUTS
EASY-TO-REACH STARTERS
DOUBLE-BAKED PORCELAIN ENAMELED REFLECTORS
STURDY MOUNTING EARS FOR CHAIN SUSPENSION
BEADED EDGE
KNOCK-OUTS FOR SWITCH OR FOR CONTINUOUS MOUNTING
BUMPER PLATE FOR PROTECTION

*AGAIN . . ALL-STEEL *Construction*

It's obvious that where men—recognized as the country's leading lighting engineers—specify SILV-A-KING—they must have good reason. There were 7 such reasons (a careful examination of the above illustration will convince you of that) . . . now there are 8—for again SILV-A-KING is made of all steel.

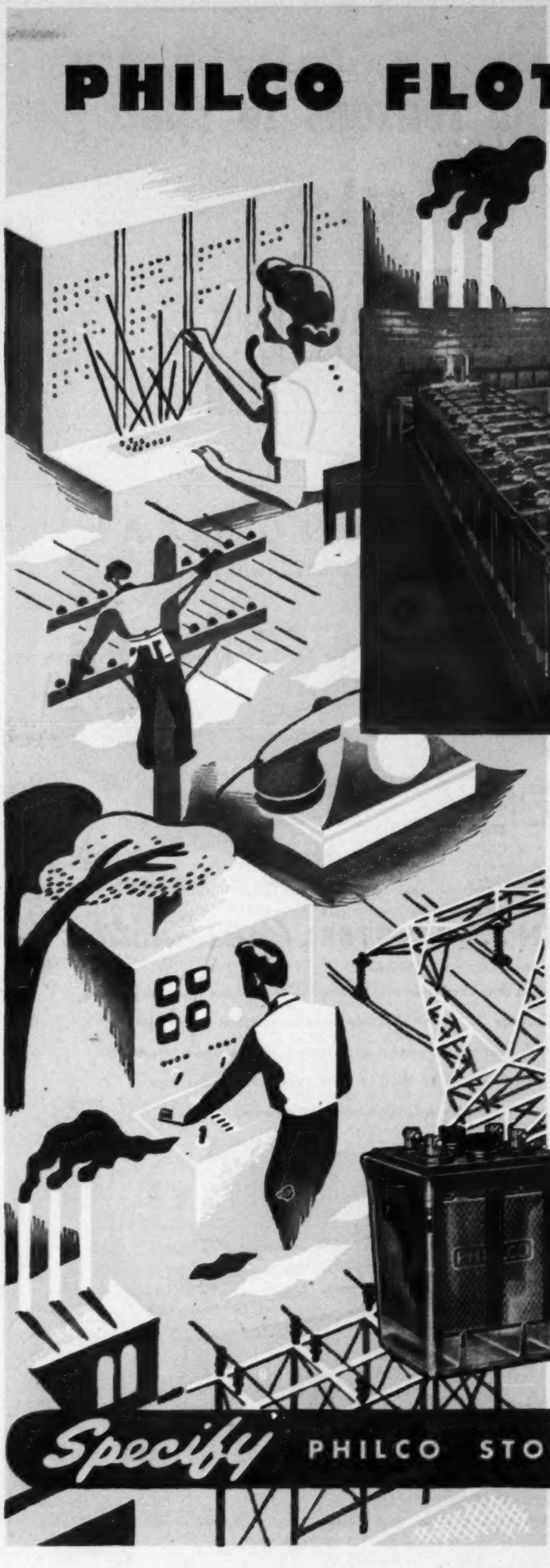


SILV-A-KING RLM UL

BRIGHT LIGHT
REFLECTOR COMPANY, INC.
METROPOLITAN AND MORGAN AVENUES • BROOKLYN 6, NEW YORK

PHILCO FLOTÉ BATTERIES

ELIMINATE THE PROBLEM OF LOW CELLS IN FULL FLOAT SERVICE



Typical Philco Battery Installation, Pennsylvania Telephone Corporation, Johnstown, Pennsylvania

When Philco engineers pioneered the famous Floté grid, they eliminated for keeps, the problem of low cells in full float service. By casting the grid in a special metal, developed by Philco research expressly for this purpose, they changed the chemical reaction within the cell so as to remove the *cause* of low cells. This important milestone in storage battery progress is one of many advanced features which make Philco Batteries tops in efficient, trouble-free performance and long service life. It is one of the reasons why so many prominent Telephone, Power, Light and Industrial companies specify Philco Batteries, over and over again. Write for latest Philco Battery catalog featuring batteries for your specialized needs.

PHILCO CORPORATION
Storage Battery Division, Trenton 7, New Jersey

Specify PHILCO STORAGE BATTERIES

ARMY E NAVY

Backed by 50 years of experience in industrial storage battery development.

NEWS ABOUT PEOPLE

J. E. Corette Assigned New Executive Duties

John E. Corette, Jr., for the past ten years legal counsel for the Montana Power Co., was elected vice president and assistant general manager of the company by the board of directors at its recent annual organization meeting.

Mr. Corette, a native of Butte, Mont.,

attended the University of Montana at Missoula and was graduated from the University of Virginia law school. He was admitted to the Montana bar in 1929.

For four years after his graduation he was a member of the law firm, Murphy and Whitlock (now Murphy, Garlington and Pauly) in Missoula. He then returned to Butte to enter the firm of Corette and Corette.

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▶ THOMAS MORGAN, 77, superintendent of the Wellston, Ohio, municipal light and power department, has resigned after 50 years of service.

▶ ELLERY B. PAINE, for 37 years a member of the faculty of electrical engineering and since 1913 head of the department of electrical engineering, University of Illinois, will retire on September 1 from active duties. While Professor Paine has given most of his active career to electrical engineering research and teaching in the University of Illinois, he filled several positions in industry early in his career, among them being connections with the General Electric Co. in Schenectady and the electrical engineering department of the Lehigh Valley Coal Co., Wilkes-Barre, Pa. He is a member of the Illinois Society of Engineers, the Society for the Promotion of Engineering Education and the Western Society of Engineers.

▶ STEPHEN K. MAHON, assistant to the president of the Toledo Edison Co., Toledo, was awarded the honorary degree of doctor of laws at the recent commencement exercises of the University of Toledo. He has been a member of the University's Board of Directors for 20 years and president of the Board since 1928.

▶ L. E. POTVIN, who recently resigned as president of the Quebec Municipal Commission, has been appointed chairman of the Quebec Hydro Electric Commission. Premier Adelard Godbout relieved Senator T. D. Bouchard of his duties as chairman of the Hydro (ELECTRICAL WORLD, July 15, page 9). Mr. Potvin had been appointed one of the five members of the Hydro Commission at the time of its creation. He had been a member of the Quebec Municipal Commission since its inception in 1932 and since 1934 he has been chairman.

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Neill Richards Assumes New Duties in Kansas

Neill Richards has been elected secretary and treasurer of the Kansas Gas & Electric Co. with headquarters at Wichita, Kans. Mr. Richards was formerly vice-president and treasurer of

Utilities Power & Light Corp. prior to its dissolution in 1940. From 1940 until taking his new office on June 1 of this year, Mr. Richards was engaged in consulting work and served with the Office of Alien Property Custodian in Chicago.

Mr. Richards brings to Kansas Gas & Electric a broad experience in operating accounting gained since 1919 with utility properties in the Middle West.

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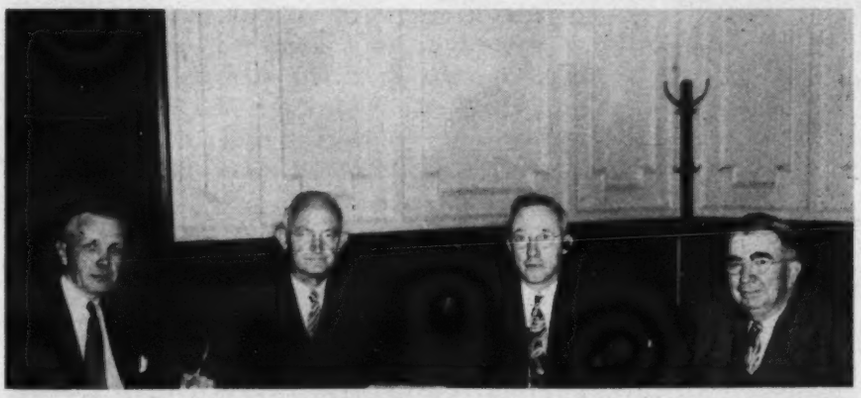
▶ E. H. DIXON has been elected executive vice president of the Electric Power & Light Corp. and the United Gas Corp.,



GEORGIA POWER PROMOTIONS—Announcement was made recently of the promotion of four officials of the Georgia Power Co. Left to right: H. W. Boozer, advanced from general auditor to comptroller; J. M. Oliver, operating manager; W. P. Hammond, general engineer and W. H. Wright, secretary and assistant to president, were elected vice-presidents. The new titles do not involve any changes in duties

SQUEEZ-GRIP— *For Carbon Dioxide is the Navy Standard*

Most people think of fire extinguishing equipment in the terms of fire department, hose, water and chemicals. But to the modern-thinking executive it is the extinguishing equipment that will put out a fire the quickest and with the least damage to materials, property and production. The SQUEEZ-GRIP valve originated by C-O-TWO, is now specified by the Navy Bureau of Ships. It is the most modern release for carbon dioxide portable extinguishers. Even an inexperienced person can operate the SQUEEZ-GRIP. No handwheel to turn; no need to set the extinguisher down. Nothing to do but squeeze the control lever over the carrying handle; aim the discharge horn at the fire; it is extinguished in split seconds—without damage to materials or equipment. SQUEEZ-GRIP Saves Time, Saves Gas, Saves Lives.

It's Safer, It's Faster

C-O-TWO

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1 NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

Affiliated with Pyrene Manufacturing Company

both units in the Electric Bond & Share Co. system. Mr. Dixon has served as secretary and treasurer and a director of both corporations since 1935. H. F. SANDERS was elected secretary of both corporations at the same time.

•

Van Tassel Directs G.E. Industrial Control Div.

K. R. Van Tassel has been named manager of the industrial control division of General Electric Co.'s industrial divisions. Mr. Van Tassel succeeds George R. Prout, recently appointed manager of the company's air conditioning and refrigeration division of the appliance and merchandise department.

A graduate of Massachusetts Institute of Technology in 1925, he joined the General Electric Co. as a student engineer the same year. In 1926 he was transferred to the transformer engineering department, Pittsfield, Mass., where he remained until 1928 when he entered the single-phase motor department there. Later he was made designing engineer of that department. Then he was transferred to the fractional-horsepower motor engineering department, Fort Wayne. In 1940, Mr. Van Tassel was made manager sales of Lynn Motors, at General Electric's Lynn Works, where he remained until 1942 when he was named manager sales of the integral-horsepower motor section of the motor division, with headquarters at Schenectady.

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▶ DR. DANIEL Q. POSIN, professor of physics at the Montana School of Mines in Butte for the past two years, recently accepted a position as physicist and member of the staff of the radiation laboratory at Massachusetts Institute of Technology, Cambridge. He will be engaged in research related to war

projects, principally high frequency radio techniques. While on the staff at the Montana School of Mines, Dr. Posin, in addition to teaching, was active in research work in artificial lighting discharges, artificial radioactivity and in radio.

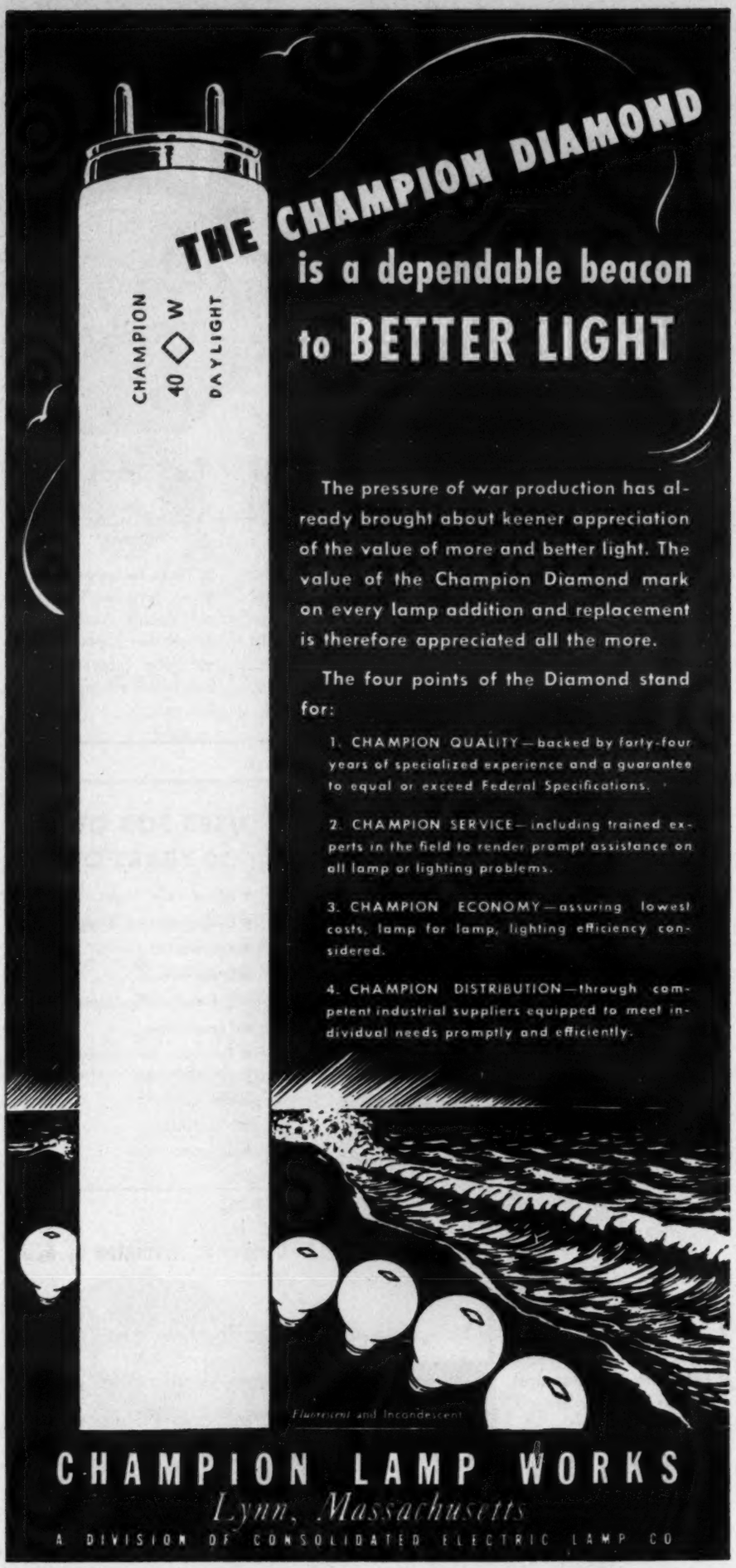
▶ DAVID M. KELLY has been appointed to the engineering staff of the John C. Dolph Co., Newark, N. J., in charge of the industrial service division. He was formerly associated with the I.T.E. Circuit Breaker Co. of Philadelphia.

▶ L. G. GILMORE has been appointed advertising manager of the National Battery Co., succeeding Kenneth Dawkins, now in military service. Mr. Gilmore was connected with the General Electric Co. for fourteen years in advertising, commercial research and sales assignments and more recently assumed administrative responsibilities in a Twin Cities plant engaged in war production. In his present capacity, Mr. Gilmore directs all automotive and industrial advertising for the National Battery Co. and its Gould commercial division, located at Depew, N. Y. His headquarters are at the company's general offices in St. Paul, Minn.

▶ J. H. FALL, JR., chairman of the board and chief executive officer of Benjamin Electric Manufacturing Co., Des Plaines, Ill., has retired from active participation in the management of the company after 32 years of service. WALTER D. STEELE, president since 1928, will direct all operations of the company.

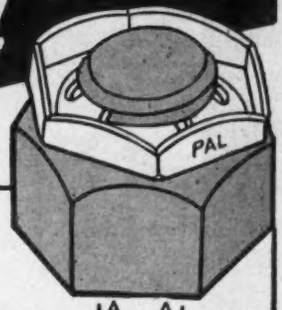
▶ RICHARD C. CARR has been appointed manager of institutional advertising for the Westinghouse Electric & Manufacturing Co. Mr. Carr will be responsible for the company's institutional copy, the commercials for the Westinghouse radio programs, the public relations production department and for other printed advertising matter. He joined the Westinghouse company in 1943, after an association with the Libby-Owens-Ford Glass Co. where he was manager of the war housing division.

▶ JOHN J. KANE has been appointed general patent attorney of the Allis-Chalmers Manufacturing Co., succeeding GEORGE F. DEWEIN, who resigned after 40 years in the Allis-Chalmers patent organization. Mr. Kane has been with Allis-Chalmers since 1912, and in recent years has been engaged in general administrative work on patent matters, in addition to special work in the particular fields of electrical rotating machinery and agricultural harvest-

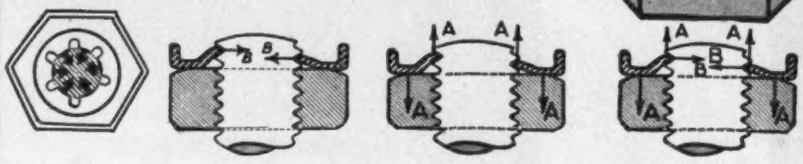

THE CHAMPION DIAMOND
is a dependable beacon
to BETTER LIGHT
CHAMPION
40 W
DAYLIGHT
The pressure of war production has already brought about keener appreciation of the value of more and better light. The value of the Champion Diamond mark on every lamp addition and replacement is therefore appreciated all the more.
The four points of the Diamond stand for:
1. CHAMPION QUALITY—backed by forty-four years of specialized experience and a guarantee to equal or exceed Federal Specifications.
2. CHAMPION SERVICE—including trained experts in the field to render prompt assistance on all lamp or lighting problems.
3. CHAMPION ECONOMY—assuring lowest costs, lamp for lamp, lighting efficiency considered.
4. CHAMPION DISTRIBUTION—through competent industrial suppliers equipped to meet individual needs promptly and efficiently.
Fluorescent and Incandescent
CHAMPION LAMP WORKS
Lynn, Massachusetts
A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO

HERE'S WHY

PALNUTS *Stay* TIGHT!



DOUBLE LOCKING ACTION!



1. When the Palnut is tightened on top of the regular nut, its arched, slotted spring steel jaws close in and grip the root of the bolt thread all around like the jaws of a chuck.

2. At the same time, powerful spring tension is exerted upward on the bolt thread and downward on the regular nut.

3. These forces combined, form the Palnut double locking action that prevents nut from loosening and bolt from backing out.

• Tight assemblies and connections are vital in power transmission, distribution and electrical equipment. For years, Double Locking PALNUTS have provided the simple, effective, low-cost answer to this need.

PALNUTS are single thread, tempered spring steel locknuts—easily, speedily applied on top of regular nuts with the fingers, locked tight with 1/3 turn of wrench. Require only 3 bolt threads space, thus can be used on new and existing assemblies. Very low in cost, may be used repeatedly. Available in full range of sizes from ¼" to 2½" bolt size, in plain, Parkerized or Galvanized steel and non-ferrous Duronze. WRITE for Utility Folder and copy of Palnut Manual No. 1 giving full details.

USED FOR OVER 10 YEARS ON:

- *Wood Pole Lines*
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- *Switches—Switchboards (indoor and outdoor)*
- *Bus Fittings*
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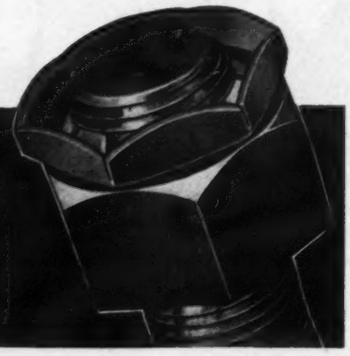
The Palnut Co., 51 Cordier St., Irvington 11, N. J.

Used Today on Aircraft, Tanks, Jeeps, Military Vehicles and other War Equipment

DOUBLE-LOCKING

PALNUTS



ing equipment. He has degrees from the Worcester Polytechnic Institute, Georgetown and George Washington Universities, and was employed for a number of years in the U. S. Patent Office. Mr. DeWein also served in the U. S. Patent Office before entering the Allis-Chalmers organization in 1904.

► HARRY R. WINKLE, comptroller and treasurer of Owens-Corning Fiberglas Corp., Toledo, Ohio, has been promoted to the position of vice president. Mr. Winkle will continue to serve as comptroller and treasurer, the position he has held since the Fiberglas Corporation was formed in 1938. He has been associated with Owens-Corning and predecessor companies since 1923.

► F. GANO CHANCE, president of the A. B. Chance Co., was recently made president of the Missouri State Chamber of Commerce. Mr. Chance has been active in many state and national organizations for a number of years. He is an active committee member of the National Association of Manufacturers, a member of the Panel of the Regional War Labor Board, a regional director of the Small War Plants Corporation and a member of the Central Missouri War Production Conference Board. Under the leadership of Mr. Chance, the state Chamber of Commerce is working on an extensive post-war program for the improvement of business conditions and civic development.

► W. N. CUMMINS, JR., assistant to R. J. Throckmorton, vice president of the Virginia Electric & Power Co. in charge of the Norfolk division, has been made director of a new created personnel department for the whole system, with headquarters in Richmond. A. Jackson, of Alexandria, Va., formerly connected with the Virginia Public Service Co., now merged with the Virginia Electric & Power Co., will be the assistant director.

► JOHN M. SMITH, general manager of manufacturing for the RCA-Victor division of Radio Corp. of America, has resigned to join P. R. Mallory & Co., Inc., Indianapolis, Ind., as vice-president in charge of manufacturing. Mr. Smith has been associated with the Radio Corp. of America for the past fourteen years. Prior to that time he was engaged for sixteen years in manufacturing activities with the incandescent lamp division of the General Electric Co., Nela Park, Cleveland.

► G. R. PROUT has been appointed manager of the air conditioning and refrigeration division of the appliance

FLOORS that act as GIANT MIRRORS

Light-Reflecting Floors made with Atlas White cement increase effectiveness of industrial lighting.

When war demanded faster production in American factories, engineers added a new function to industrial floors. Large in size and closest to working areas, floors made with Atlas *White* cement (instead of *gray* cement) act as giant reflectors of light, augmenting the well-known effectiveness of light-colored walls and ceilings.

Light-Reflecting Floors made with Atlas White cement have proved their value wherever installed. In one bomber plant tests showed a 61% increase in light reflection compared to an adjacent gray-cement floor under identical lighting. They break up shadows, put more light on working surfaces, and improve seeing on all jobs. Because they are made of Atlas White cement, their reflection value is lasting.

For full information on Light-Reflecting Floors, including results of lighting surveys and experience of maintenance engineers, ask for the booklet "Light From Floors." Write to Atlas White Bureau, Universal Atlas Cement Co. (United States Steel Corporation Subsidiary), Chrysler Building, New York 17, N. Y.

HOW ABOUT MAINTENANCE?

Experience shows white-cement floors are easy to clean, easy to keep clean, and retain their reflection advantage. Maintenance is simple—frequent sweeping, occasional damp mopping, periodic scrubbing.

EW-P-20

ATLAS WHITE CEMENT
For Light-Reflecting Floors

Do You Buy LIGHT OR LAMPS?

Do you know that "current" represents 90% of the cost of "light"? And that about 10% of the cost is the lamp? In brief, here is the simple economics of street lighting costs: An inferior lamp can waste approximately 25% of the current, without your knowledge.

Such waste is prevalent throughout many cities, towns, and along many of the nation's highways. It is a waste that can be avoided. All that you require to turn this waste into useful service is to investigate SLATER LABORATORY TESTING FACILITIES which show in advance what you will get out of any batch of lamps.

Here, at SLATER, is one of the most complete and modern scientific laboratories where constant research helps make SLATER lamps as strong and uniform as possible.

A trial order will convince you of SLATER quality and long life.

Catalog and Price List upon request.

Photometer reading at SLATER laboratory.

SLATER ELECTRIC & MFG. CO.
BROOKLYN, NEW YORK
MANUFACTURERS OF STREET LIGHTING LAMPS, AND PRECISION ELECTRONIC TUBES

Guth

In 1942--We Introduced

QUICK-LITER*

The Original Starterless

FLUORESCENT!

Two Years of Rigid Testing Have Proved Its Worth!

The GUTH QUICK-LITER was originated for War Plants; where high maintenance costs due to Starter-Switch troubles, and variable line-voltage conditions, made *Starterless* Fluorescent desirable. Detailed performance records were maintained, so that every claim made for QUICK-LITER has been *proved* by use.

A valuable report on the results of these tests is now available. Write for your copy today.

No Starter Switches

Maintenance cost is lower, and the problem of chucking for "dead" Starters is eliminated.

Lights Instantly

At the flick of the switch—there's light! No flickering, flashing, or waiting.

Long Lamp Life

QUICK-LITER gets maximum usage from lamps.

Operates at Irregular or Low Voltage

QUICK-LITER *starts and operates* at as low as 85 Volts.

Would Operate in an Ice Box

QUICK-LITERS start and operate as low as 0° F. Temperature. Many are now in use in Alaska and the Aleutians.

Immediately Available

QUICK-LITERS can be shipped at once on AA-5, or AA-2-MRO, or higher priorities.

Guth *QUICK-LITER
TRADE MARK

The Edwin F. Guth Co. • 2615 Washington Ave. • St. Louis 3, Mo.

and merchandise department of the General Electric Co. He will be located in Bloomfield, N. J., where headquarters of the company's air conditioning and commercial refrigeration activities are located. Prior to his new appointment, Mr. Prout was manager of the industrial control division in the company's general office at Schenectady. He has been with General Electric since his graduation from the Massachusetts Institute of Technology in 1923. As new manager of the air conditioning and commercial refrigeration division, he succeeds J. P. Rainbault, resigned.

► WILLIAM E. KRESS has been appointed sales manager of the Middle West for Philco Corp., with headquarters in Chicago. Mr. Kress succeeds JOHN M. OTTER, who was named sales manager for the Home Radio Division. Mr. Kress joined Philco in 1934 and for the past two years he has been southwestern division manager with headquarters in Kansas City.

OBITUARY

► EUGENE A. RUMSEY, president of the Rumsey Electric Co., Philadelphia, Pa., died on July 8 in the Hahnemann Hospital, after a long illness. He was 77 years of age. A graduate of Cornell University in electrical engineering, Mr. Rumsey, with his brother George A. Rumsey, founded the Rumsey Electric Co. in 1895.

► E. B. WHIPPLE, 63, for the past 17 years in charge of the service department of the Elko Lamoille Power Co., Elko, Nev., died from a heart attack July 2.

► OSWALD C. GRALL, 56, superintendent of the Huron (O.) Light and Water Works, died suddenly June 23 in that city.

► CHARLES L. SMITH, 75, formerly superintendent of the transformer department of the General Electric Co., at Lynn, Mass., and lately retired, died at his home in that city on July 4. His connection with the company covered 45 years.

► LT. PHILIP M. CHILDS, U.S.N.R., for some years president of the public utilities forming a part of the then Massachusetts Lighting Companies, Boston, died recently at San Juan, Puerto Rico. He was born in Boston in 1896, and was educated at Harvard University and Montreux, Switzerland. In 1926 he was named vice-president of the Massachusetts Lighting group to relieve his father, the late Arthur E. Childs, president, on account of ill health. Lt. Childs

Guardians of Cable Insulations

They Prevent Secondary-Network Short-Circuit Currents from Spreading Away from Faults to Damage Cables

SHELDON-ENGINEERED LIMITERS

MADE of 98%-conductivity copper. All surfaces are tinned. Designed so that their time-current characteristics approximate the insulation - damage characteristics of this cable.

Installed by the use of a portable hydraulic-press; protected by arc-proof, asbestos - cement shells and rubber jackets, which make these Sheldon Limiters good for operating voltages up to 600.

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SHELDON Service Corp.
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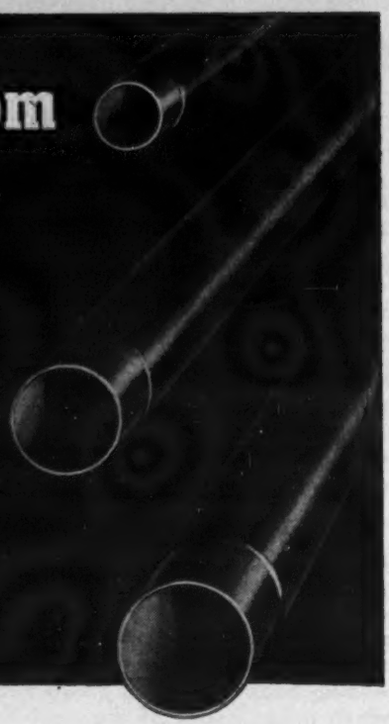
"You're Well Connected with SHELDON"

Protection from CABLE ABRASION Now . . . and Years from Now!



Scoring of sheath, the first hazard in the life of a cable, is at a minimum when cable is pulled through Orangeburg Conduit.

ORANGEBURG FIBRE CONDUIT is non-abrasive and has a low coefficient of friction. Pulling tensions are kept low, preventing undue strains in cable. A typical Orangeburg installation by one large utility, where cable tensions were carefully watched, showed the following results:

Size of Cable	*Size of Duct*	*Length of Pull*	*Coefficient of Friction*
300,000 c.m. 2¼"	O.D. 3½"	800-900 ft.	.25 – .30
650,000 c.m. 2½"	O.D. 4"	800-900 ft.	.25 – .30

A recheck of this installation two years later showed that the coefficient of friction was unchanged.

ORANGEBURG FIBRE CONDUIT is non-corrosive. Made only of cellulose fibre and coal tar pitch, ORANGEBURG does not require curing; nor is it subject to changes which might release salts injurious to cable sheath.

ORANGEBURG FIBRE CONDUIT is non-corrodible. Ground waters or wastes, entering the manholes or ducts do not disintegrate it or form corrosive by-products which might react unfavorably on cable sheath.

ORANGEBURG STANDARD
for installation *with* concrete encasement

•

ORANGEBURG NOCRETE
for installation *without* concrete encasement

ORANGEBURG FIBRE CONDUIT is non-metallic, non-cementitious and non-conductive. It is unaffected by electrolysis, and does not of itself act as an electrolyte.

ORANGEBURG FIBRE CONDUIT is easy to install. The taper sleeve joint assures accurate alignment of lengths for a continuous and true raceway.

ORANGEBURG is economical—low in first cost, low in ultimate cost as proved by over 50 years' service in the underground protection of electrical cables.

Write for new Catalog No. 49.

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THE FIBRE CONDUIT CO. ORANGEBURG N.Y.

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WITH 50 YEARS EXPERIENCE IN THE MANUFACTURE OF NON-METALLIC CONDUIT AND PIPE, SERVES THE POWER AND LIGHT, TELEPHONE, GENERAL CONSTRUCTION, CHEMICAL, PETROLEUM, PLUMBING AND BUILDING SUPPLY FIELDS WITH ELECTRICAL FIBRE CONDUIT . . . ELECTRICAL UNDERFLOOR DUCT SYSTEMS . . . AND FIBRE PIPE FOR NON-PRESSURE USES.

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And that isn't all. Even when your name does come up we shall not be able to supply the missed copies to fill out your file. We have no more extra copies.

This is an unusual situation for a publisher to face but the fact is that paper is extremely short due both to an increased demand for packaging of war materials for shipment overseas and to a shortage of labor in the woods. Supply of wood products of which paper is one of the most important is in the same critical position that copper products were in a year ago.

Like all other publications, we are operating under a fixed allotment of paper, having had two cuts. We did not cut the editorial content nor reduce the number of subscribers. What we did was to freeze our circulation at the current figure and then, as waiting lines of new subscribers began to grow, we adopted the policy of cutting off subscriptions promptly on expiration—not, however, without giving each subscriber at least four notices of expiration in time for him to send in his renewal.

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We will do everything within our power to serve you without a break if you will help us. Please answer renewal notices promptly.

Electrical World

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Modern Operational Mathematics in Engineering

Just Published!

By RUEL V. CHURCHILL

Professor of Mathematics, University of Michigan

306 pages, 6 x 9, 106 illustrations, $3.50

Here is a sound, clearly presented treatment of the theory of the Laplace transformation, and its use in various problems of engineering and physics. The book shows how to apply this method to problems involving differential equations, with special attention to boundary value problems in partial differential equations. Exact methods and step by step procedures are clearly demonstrated by means of worked-out examples and illustrative problems.

- **all important results are stated as theorums**
- **over 110 worked-out examples and illustrative problems**
- **3 tables of transforms in the text, 2 in the appendix, making the first convenient large collection of Laplace transforms**
- **200 problems for the reader**

Exact methods are clearly illustrated by worked-out examples of practical problems dealing with such questions as: free vibrations of a mass on a string; static deflection of beams; temperatures in a slab; a semi-infinite radiating wire; resonance in a bar with a fixed end; potential in a slot; temperature when thermal coefficients vary with time.

- **The book explains the operational properties of the Sturm-Liouville expansion and Fourier transforms and shows how they can be used to solve certain types of boundary value problems.**

CHAPTERS

1. **The Laplace Transformation**
2. **Further Properties of the Transformation**
3. **Elementary Applications**
4. **Problems in Partial Differential Equations**
5. **Functions of a Complex Variable**
6. **The Inversion Integral**
7. **Problems in Heat Conduction**
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was made president of these companies in 1930, but relinquished the duties of that office in 1934, becoming vice-president again, and serving in that capacity as an executive of the New England Power System affiliation.

▶ ALBERT E. JOSSELYN, 80, formerly a member of the power sales staff and later superintendent of the then information department of the Boston Edison Co., died in Boston July 4. He was a native of Watertown, Mass., and was employed by the company from 1889 to 1929.

▶ OLIVER J. SCHIEBER, 55, for 30 years a civil engineer for the Southern California Edison Co., died June 23 in Los Angeles, Calif. Mr. Schieber also served as division superintendent of the Metropolitan Water District in Los Angeles for seven years.

▶ WILLIAM J. MOWBRAY, 68, formerly head of the meter department, Narragansett Electric Co., Providence, R. I., and for the past twelve years instructor in electrical engineering at Rhode Island State College, died at Wakefield, R. I., July 4. He was born in Drumholm, Ireland, and was educated at Pratt Institute and Brooklyn Polytechnic Institute. Mr. Mowbray, as assistant engineer, was at one time in charge of the laboratory of the Narragansett company, and his writings included many technical articles and a book, "Trigonometry Made Easy," for use in the field of adult education. He was a Fellow of the A.I.E.E. and member of other professional societies.

▶ HARRY D. FALLS, 80 years old, who retired two years ago as head of the Brazil division of the Public Service Co. of Indiana, died recently at his home in that city. He had been head of electric utilities there for nearly 40 years.

▶ GUY K. DUSTIN, manager of the western district of the New England Power System, died recently at Northampton, Mass. He was born in Hartford, Conn., and was graduated from Yale University in 1899. In his early career he was associated with utilities at Binghamton, N. Y., Chicago, Hartford, and Columbia, S. C. In 1914 Mr. Dustin joined the then Massachusetts Lighting Companies group at Boston as general manager of its operating subsidiaries and president of the Gas & Electric Improvement (managing) Co., until 1930, when these utilities joined the New England Power Association system. In 1931 he was established at Northampton, Mass., as western district manager and was prominent in civic affairs.

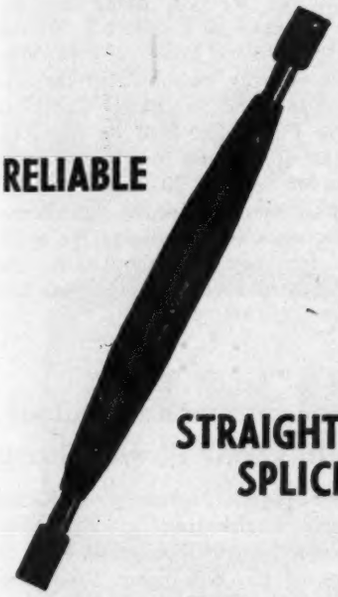
RELIABLE CAN HELP YOU

SAVE TIME

in speeding the war program by using Reliable Straightline splices on new construction and on maintenance.

SAVE COPPER

by using these perfect joint making units over and over again.



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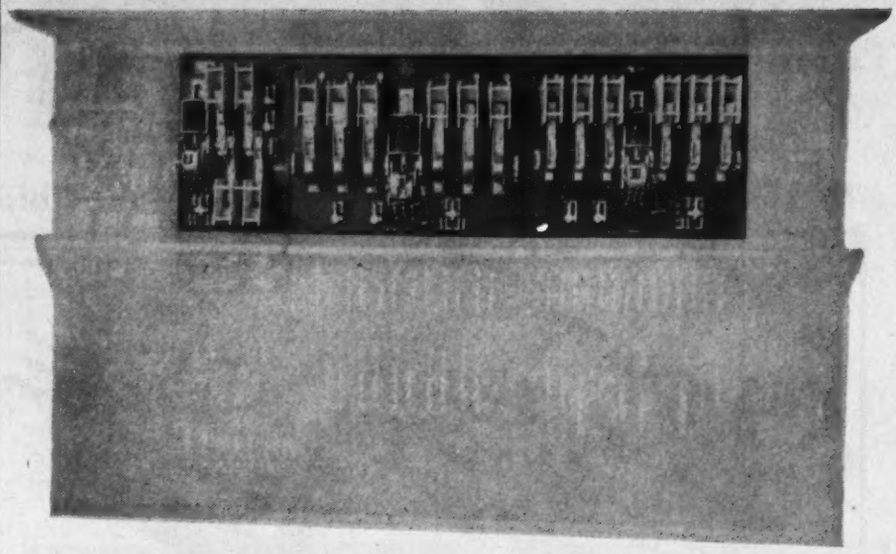
Permanent
Low in Cost

Reliable
ELECTRIC COMPANY
OVER 35 YEARS SERVICE TO THE UTILITIES
3645 CARROLL AVENUE · CHICAGO 12 ILLINOIS

The Makeup of *Outstanding* Switchboards



EMPIRE Relies upon ASCO *for* Automatic Transfer Switches

A switchboard or panel board is a joint responsibility—the responsibility of the manufacturer and of those who furnish the component parts. We have always accepted our share of this responsibility by designing and constructing automatic transfer and other electrically operated switches that give dependable service.

Among the leading manufacturers of switchboards whom we are furnishing electrically operated switches is Empire Switchboard Corporation, Brooklyn, N. Y. ASCO Automatic Transfer Switches are installed on the marine type switchboard illustrated above . . . further evidence of the reliability of ASCO Automatic Switches.

ASCO *Electrically Operated Switches Include:*

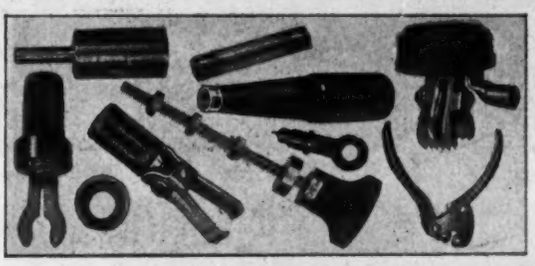
AUTOMATIC TRANSFER SWITCHES
REMOTE CONTROL SWITCHES
CONTACTORS • RELAYS

We also make a line of Solenoid Operated Valves for Automatic and Remote Control of Liquids and Gases

ASCO Electrically Operated SWITCHES

Automatic Switch Co.
41-C East 11th Street, New York 3, N. Y.

7-AS-7



SWITCHES, ENCLOSURES, ACCESSORIES

• The largest exclusive manufacturer of meter testing devices stocks a complete line of accessories for the modern meter department. Many items available for immediate delivery.

METER DEVICES COMPANY • Canton, Ohio

ELECTRITE

A high grade fibre board for electrical insulation. A material of quality possessing high tensile and dielectric strength. Used by many of the leading manufacturers of electrical equipment.

DENSITE

An extremely hard board of superior quality which can replace the more expensive types of insulating materials.

Pulp Products Department

WEST VIRGINIA PULP & PAPER COMPANY

AVOID CABLE ABRASION *with*

STAPUT FAIRLEADERS

"Rubbing at the duct mouth can be reduced by installing fairleaders on the cables at this point." — from Electrical World, May 29, 1943 (Cables — How to Make Them Last).

These non-corrosive alloy cable shields clamp in place to take wear at duct mouth. Easily and safely installed without interruption of service. Eliminate expensive repairs. Use STAPUT FAIRLEADERS. *Write for free catalog.*

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April Utility Revenues Increase 7.7 Percent

Electric operating revenues of the larger privately-owned electric utilities in the United States in April, 1944, were $254,574,000, as compared to $236,403,000 in April, 1943, an increase of 7.7 percent, according to preliminary figures released by the Federal Power Commission in advance of its monthly report in the series entitled "Revenues and Income of Privately-Owned Class A and Class B Electric Utilities in the United States."

Revenue deductions (including operating expenses, depreciation and taxes) were $197,658,000, or 8.7 percent over those of April, 1943.

Gross income, including other utility operating income, increased 4.0 percent to $69,338,000 and net income in April, 1944, was $44,089,000, an increase of 6.0 percent from the net for April, 1943.

•

FPC Authorizes Merging of Company Facilities

The Federal Power Commission announced today its order authorizing the California Electric Power Co., Riverside, Calif., (1) to merge its facilities subject to the Commission's jurisdiction with the electric utility facilities of Leonard P. Wickoff, doing business under the name of Leonard P. Wickoff Electric Light and Power, and (2) to issue the security embodied in the contract of sale and purchase. California Electric Power Co. filed on April 18, 1944, an application for the authorization under Sections 203 and 204 of the Federal Power Act, or, in the alternative, for an order dismissing the application for want of jurisdiction. An amendment to the application was filed on May 12, 1944.

•

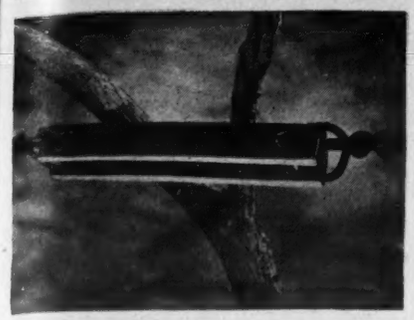
Heads Equipment Output Unit, OWU Power Group

Lester Bosch, formerly with the Columbia Engineering Co., of Cincinnati, has replaced Chandler W. Jones as director of the Equipment Production Branch of the OWU Power Division.

Jones has returned to Boston where he will be assistant to the president of the New England Power Association, with which he was affiliated before coming to Washington in October, 1941, as a consultant with the old Power Division of OPM. Jones became head of the Equipment Production Branch last fall after Walker Cisler entered the Army.

No deputy director has been appointed to serve under Bosch.

TREES



A problem in public relations . . . or just an insulating problem

PINCO tree insulators provide the answer

Costing less than a single tree trimming, a Pinco Tree Insulator pays for itself in a short time, not only in dollars and cents savings but also in the grief it saves the public relations department.

ALL PORCELAIN . . . Made entirely of Pinco High Test Porcelain it offers the insulating protection only porcelain can give and is unaffected by moisture or the abrasive action of rubbing branches.

EASILY INSTALLED . . . The Pinco Tree Insulator is easy to install. It needs only to be placed *on* the wire at the point of contact and secured at each end with tie-wires. Available in 12, 14 and 16 inch lengths. Where needed several units may be tied together. Write for complete information and prices.

Pinco Insulators are catalogued in the Electrical Buyers Reference

PINCO
INSULATORS

THE PORCELAIN INSULATOR CORPORATION
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Gentlemen:
Please send me complete information on Pinco Tree Insulators:

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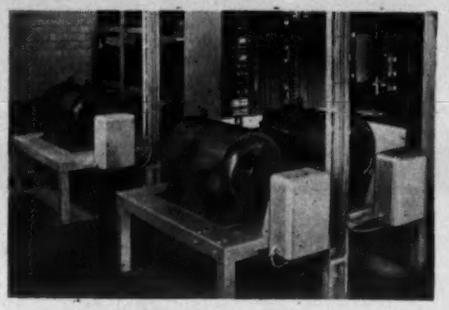
THE DIVERTER POLE MOTOR GENERATOR

Greatly Decreases Battery and Charging Equipment Maintenance

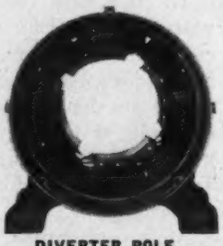


The Diverter Pole Motor Generator, specially designed, carefully constructed, adjusted within precision limits and completely automatic in operation, is ideally adapted to the charging of standby and control batteries. Among the many reasons why it insures safety, stability and economy for floating charge are . . . .

- Un-attended Automatic constant charging voltage that insures:—
  Control of the charging voltage within close limits at all times.
  A continuous floating charge to the battery at all times, which alone will insure longest life, highest efficiency and lowest maintenance.
- Is non-reversible and free from "running away" on power discharge from battery into generator.
- Automatically transfers to the battery any current demands beyond the normal capacity of generator, thus protecting itself against dangerous overloads.

The Diverter Pole Generator has the unqualified approval of the storage battery manufacturers and is delivering maximum efficiency and trouble-free service for utilities in all sections of the country.

Write for Bulletin 96 for complete details.



DIVERTER POLE GENERATOR CONSTRUCTION

The Electric Products Co.

1731 CLARKSTONE ROAD · CLEVELAND 12, OHIO

Blackburn "Gripits" cost about half as much as split bolt connectors, and do the same job at the house service entrance. Save by using them! "Gripits" are made of a high-strength copper alloy — actually stronger than steel. Circular construction gives extra strength. "Gripits" will not stretch or distort when tightened — will not come loose.

Hundreds of thousands in use throughout the world

Over 75 Conveniently-located Jobbers' Stocks

JASPER BLACKBURN PRODUCTS CORP.
Main and Clinton Sts. · ST. LOUIS (6), MO.
Builders of Quality Connectors for Over 10 Years

MANUFACTURING MARKETS

Forms Water Heater, Dishwasher Unit

To plan now for anticipated heavy postwar demand for electric water heaters and dishwashers, the Westinghouse Electric appliance division has formed a separate department to give increased emphasis to the development, improvement, and marketing of these devices, T. J. Newcomb, sales manager, has announced.

At the same time, Mr. Newcomb announced the appointment of M. M. Feaman, as manager of this new water heater and dishwasher department. These appliances previously were assigned to the Range Department.

Mr. Feaman is active in an industry-wide program to standardize electric water heater equipment—both electric heating elements and tanks—which it is expected will reduce the cost per unit because of more streamlined production methods of manufacture. A similar study of dishwasher design and production to achieve mass market requirements also will be undertaken.

Westinghouse anticipates that annual sales of electric water heaters and dishwashers during the first five post-war years "will far surpass the peak years of 1941" Mr. Feaman predicted. He anticipates that electric water heater sales will more than double the previous high and that dishwasher sales will be at least eight times greater than the 1941 level.

Mr. Feaman has been with Westinghouse since 1931.

•

Carrier Stockholders to Vote on New Issue

Carrier Corp. stockholders will vote on a plan to increase capitalization at a special meeting called for August 15. Shareholders will be asked to authorize a new issue of 120,000 shares of cumulative preferred, $50 par value, of which 70,000 shares will be issued and sold in the near future.

The new preferred will be convertible into common stock, and will be offered to the present common stockholders in the ratio of 16 shares of new preferred for each 100 shares of common.

Proceeds from the sale of the new preferred will be used to retire all the outstanding 4½ percent debentures, to improve manufacturing facilities, and to provide for post-war expansion.

Offering price of the new issue and its conversion feature will be announced at the time of offering.

•

"HF Heat" Applies Ham's Headaches

In applying electronic power to generate heat in industrial materials, engineers are putting to constructive use an electrical phenomena that caused many headaches for amateur set builders in the early days of radio, according to Merrill F. Chapin, of the RCA Victor Division of the Radio Corporation of America.

Speaking at a meeting of the Plastics Forum at the Franklin Institute, in Philadelphia, Mr. Chapin pointed out that every "ham" operator has worried about power losses, particularly in the tuning condensers and to some extent in the coil forms of his sets. "The more material we had lying around in our coils or in the electrostatic field of our condensers," he recalled, "the more power we lost in the form of heat generated in the insulating materials."

"Now, with electronic power generators such as those which RCA is supplying to war industries today," he said, "we are purposely heating insulating materials such as wood, plastics, textiles, and resins, making use of the loss factor of these materials. As compared with other methods of heating, the electronic method is improving product quality and cutting process time from hours to minutes in many applications."

•

Copper For Light Fixtures Only If Aid to War Effort

Manufacturers of incandescent lighting fixtures were urged to call to the attention of WPB any applications where the use of copper would directly or indirectly benefit war production, and were informed by WPB that only in these cases will present restrictions on copper use be relaxed.

Manpower difficulties are principally responsible for the current scarcity of copper, members of the Incandescent

CHROMALOX ENGINEERING CONFERENCE—Engineering and service representatives from the United States and Canada gathered recently in Pittsburgh for the annual sales and engineering conference of the Edwin L. Wiegand Co., manufacturer of Chromalox heating units. Many demonstrations were given showing how the use of electric heat had advanced the production of war material, and will aid peacetime output. Foreground (center) E. N. Calhoun, president; (left) Bruce Fleming, vice-president, sales; (right) Mark Greer, vice-president, engineering

ighting Fixture Industry Advisory ommittee were told. Aluminum probly will soon be permitted for many ghting fixtures formerly made of copr or brass, although aluminum strip d paint may be difficult to obtain. Committee members urged that WPB move existing restrictions against anufacture of residential and utility xtures as soon as the manpower situaon warrants.

•

Offer "U" Plan Dealers New Direct Mail Service

Continuing with its policy of adding ew and timely services to the "U" Plan for "V" Day to assist dealers in heir post-war planning, Landers, Frary Clark has incorporated a novel plan reated to build lists of prospective ustomers. Known as the "100 Letter Plan", it is a flexible, direct mail service esigned for easy, economical customer ontact.

The program is based on a pre-tested ormula which has resulted in excellent eturns of approximately $300 of postwar business per each 100 letters mailed to consumers.

The "100 Letter Plan" mailing kit s composed of a special check sheet etter and consumer folder outlining he "U" Plan for "V" Day. On one ide of the letter is a list of appliances nd housewares together with the 1941 ange of prices, plus space for estimated ost and total cost. On the other side s a letter telling of the dealer's interst in the consumer's post-war planning for appliances and housewares, uggesting that she fill out the check heet and return it to the dealer.

The total cost of this base unit of 100 "U" Plan letters, including consumer folders, envelopes and stamps is 3.00 per week. The letter and consumer folder are furnished under the "U" Plan, so all the dealer needs to do is address the mailing.

•

Set Up Porcelain Group

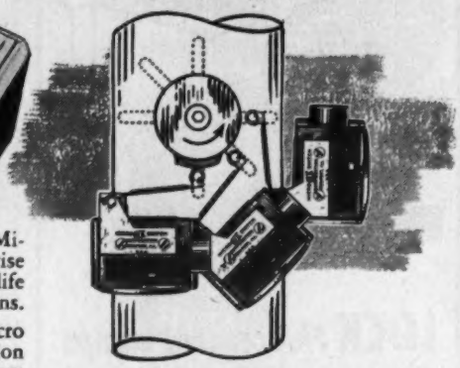
The Board of Governors of the National Electrical Manufacturers Association has authorized the establishment of a standard electrical porcelain section, the scope of which is to be approved by the Officers Committee.

•

Stockholders at New High

General Electric stockholders totalled 232,332 on June 23, the highest number ever to own stock in the company. This is an increase of 6,737 over a year ago.

Hundreds of Spots for Micro Switch in a Utility System



There are hundreds of applications for Micro Switches in the Utility Field. Its precise operation, close adjustment and long life make it fit the most exacting applications.

Illustrated here is the use of three Micro Switches on a remote draft position indicator. They are operated by a cam on the draft shaft, and make contact at "open," "half," and "closed" positions.

The basic Micro Switch is a thumb-size, feather-light, plastic enclosed, precision, snap-action switch, Underwriters' listed and rated at 1200 V.A., at 125 to 460 volts a-c. Capacity on d-c depends on load characteristics. Accurate repeat performance is experienced over millions of operations. Wide variety of basic switches and actuators meets requirements varying from high vibration resistance to sensitivity of operating force and motion as low as 2/1000 ounce-inches. Many types of metal housings are available.

Micro Switch Handbook-Catalog No. 60 contains complete details as to electrical characteristics, construction, applications, dimensions, and other information. We will be glad to mail it to you on request. Write for it today.

Micro Switch Corporation, Freeport, Ill.

Branches: 43 E. Ohio Street, Chicago (11) • 4900 Euclid Ave., Cleveland (3) • 11 Park Pl., New York City (7) • 1709 W. 8th St., Los Angeles (14) • Sales & Engineering Offices: Boston • Hartford • Portland, Ore. • Dallas, Tex.

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The trademark MICRO SWITCH is our property and identifies switches made by Micro Switch Corporation

MICRO MS SWITCH

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Made Only By Micro Switch Corporation . . . Freeport, Illinois, U. S. A.

the vital link for

100% PRODUCTION . . .

KLIPLOK Clamps

SAVE

FUSES — CLIPS — POWER

Poor fuse clip contact creates excessive temperatures, causing fuse clips to lose their tension. Fuses become destroyed or blow prematurely, resulting in unnecessary costly production losses—repairs—wasted current, etc.

TRICO KLIPLOKS stop this deplorable waste by locking fuses and clips together, producing vise-like PRESSURE contact. Install them on old clips to remedy existing trouble—on new clips to avoid trouble. USE KLIPLOKS FREELY Write for Bulletin #6

Knife blade type

Ferrule type

USE TRICO PULLERS

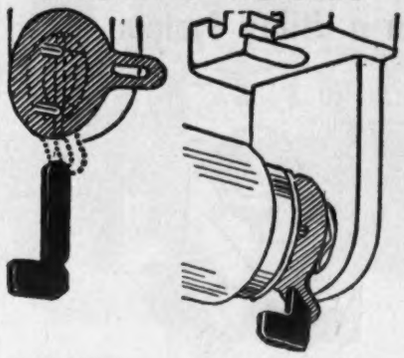
A lifetime of safety-first service

Pulling fuses by hand is dangerous. It may result in serious shock, burn, infection and possible death. Key men and inexperienced workers need this protection. Keep men on the job . . . not on the injury list.

Write for Bulletin #5

TRICO FUSE MFG. CO., Milwaukee, Wis.
In Canada: IRVING SMITH LIMITED, Montreal

"FLUR-O-LOCKS"



LOCK Fluorescent Lamps
against
VIBRATION DIFFICULTIES

It is a conceded fact that vibration at fluorescent lamp contacts considerably impairs the efficiency of lamps, starters and ballasts. Flur-o-locks aid materially in preventing this condition. Furthermore Flur-o-locks insure the proper installation of lamps and offer definite protection against accident hazards wherein lamps are apt to fall from a fixture. Such accidents have occurred causing quite some material damage and personal injury. FOR SAFETY AND CONSERVATION USE FLUR-O-LOCKS.

Write for Further Information

LADUBY COMPANY
180 Oak Street
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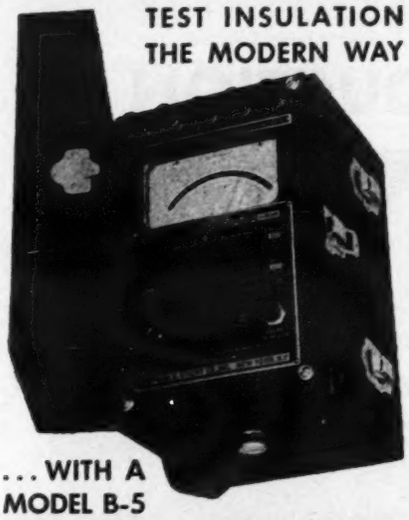
TEST INSULATION
THE MODERN WAY



... WITH A
MODEL B-5
MEGOHMER
NEW BATTERY-VIBRATOR TYPE

No more tiresome cranking of a hand-driven generator. Entirely self-contained. Steady test potential of 500 volts D.C. available at the touch of a switch. Direct reading in insulation resistance. Various new models and ranges.

Write or phone for Bulletin 430

HERMAN H. Sticht COMPANY, INC.
27 PARK PLACE NEW YORK, N. Y.

Field Reports on Business

Reports from various sections of the country indicate that only a limited number of facilities will be diverted from the war program. There is considerable activity in the lighting field, many new installations being made. Prospects for future electric furnace sales are bright.

CHICAGO

Expectation here is that only limited facilities in Chicago will be able to qualify to produce essential civilian goods under the WPB program which went into effect July 15.

Chicago's position, overloaded with war orders, will prevent its plants from reconverting to any large degree to civilian production until months after both the European and Pacific wars are ended, in the opinion of WPB executives here.

Government buying agencies are planning to place soon more orders than those which will be halted by expiration or cancellation. As a result, only a limited number of facilities will be diverted from the war program. Even in these cases most of the actual production will be done in other areas through subcontractors. For example, five Chicago plants are making flat irons, but 85 percent of the work is by subcontract to areas outside Chicago where there is no labor shortage.

In the Moline, Rock Island, Davenport area on the other hand the Smaller War Plant Corporation reports that about 12 manufacturing plants will qualify within a few months to produce essential civilian items under the WPB program.

On the industrial development front Buick Motor Division of General Motors Corp., Flint, plans to expand aviation engine plants to increase capacity for government service. The project calls for about $18,000,000 in new buildings, with electrical apparatus and machinery, and will be DPC financed.

NEW ENGLAND

New England industries are beginning to step up production as a result of last week's awards of contracts for munitions under the new $100,000,000 ordnance appropriation. Two Connecticut companies were awarded munition contracts last week; large special machine tools are active, and the prospects for future electric furnace sales are brighter. Rubber plants are receiving more allotments for new machinery.

Last week's Veteran's Administration $10,000,000 allocations for new hospitals included recommendations for units in Rhode Island and New Hampshire, the construction of which will be pushed forward as fast as possible, and should result in good orders for electrical equipment and supplies. A grant of $150,000 to the Middle Atlantic Transportation Co., New Britain, Conn., is to apply on automotive equipment and should produce sales of special electrical equipment for the automotive line.

Contracts for war materials went to Plymouth Rubber Co., friction tape; Hope Webbing Co., Providence, R. I., insulating material; Sprague Electric Co., resistors; Macallen Co., Boston, insulating materials; a distillation unit costing about $20,000 to E. B. Badger & Sons Co., Boston; and special machine tool awards to Brown & Sharpe, for d.c., 230-volt grinders; shapers to Lloyd & Arms Co., Torrington, Conn.; turret lathes to Jones & Lamson; and lathes to Pratt & Whitney. One group of these totaled over $18,000.

Coken Co., Providence, R. I., has received contracts for installing street lighting in West Hartford, Conn., and Falmouth, Mass., under FHA directive. Portable electric fans are scarce and in urgent demand for local hospitals. A Massachusetts manufacturer has submitted bids for a sizable number of hot plates and a Connecticut company has bid on a schedule calling for more than $20,000 in electric soldering irons for ship use.

NEW YORK

Official warnings are being issued about lags in war production, the charge being made that schedules are not being met.

During the first week in July business in the Pittsburgh district tumbled to the lowest level reported since the week ended Jan. 1, 1944, according to the Bureau of Business Research, University of Pittsburgh. Sharp declines in production schedules were reflected in all major industries in the district.

Civil engineering construction volume in continental United States totaled $62,510,000 last week, the second highest weekly total reported to *Engineering News-Record* in 1944. This volume topped the $18,922,000 reported for the holiday-shortened preceding week, but was 40 percent lower than in the corresponding 1943 week. Public work was 41 percent below the week last year as a result of the 48 percent drop in federal construction.

On Monday of last week the stock market reached its highest point in four years. Cash dividends in the United States aggregated $114,200,000 in May, compared with $115,300,000 in May, 1943, the Commerce Department reports.

PACIFIC COAST

The recent call for 200 electricians for repair and refit service at Hunters Point drydock with prospective work for 200 more is further evidence of how the Pacific war is directly reflected upon Pacific Coast electrical business. Orders include $30,000 transformers for Naval replacement centers; $15,000 switchgear equipment for Honolulu; three 2,000 kva. and one 150 kva. transformers for Oakland pumping plant; a $109,000 award for night lighting of a California bomber base, and $20,000 of testing instruments for Mare Island.

New government construction covers several $2,000,000 installations, such as two California air stations and a Naval Supply depot in the Northwest with its six 600-foot warehouses. One base plans to enlarge its central steam generating plant from a new appropriation of $700,000. Almost the last of California's seasonal industries—mining in remote areas—is now in operation. Santa Fe's new shops in Barstow, Calif. for repair of its diesel electric locomotives will represent a $900,000 investment.

Housing has again reappeared as a major construction item, chiefly in scattered industrial areas with $500,000 rating as a large project except in the Long Beach district which is outstanding of FHA's approval of a 350 dwelling private tract, totaling $1,750,000, besides five community buildings and a $1,500,000 wharf.

Sales Opportunities

NEBRASKA—Consumers Public Power District, Columbus, plans new 33,000-volt transmission line from connection with present system for distance of about 170 miles for power supply for alfalfa dehydrating mill of Meyer Milling Co. Substation will be provided at line terminus for step-down service. Application has been made for permission and work will begin as soon as granted.

CALIFORNIA—Northrop Aircraft, Inc., Hawthorne, will carry out expansion in plant for production for government, with installation of additional machinery and electrical equipment. Cost estimated about $465,000, with financing by Defense Plant Corp. Work is scheduled to begin at once.

FLORIDA—Bureau of Yards and Docks, Navy Department, Washington, D. C., plans power plant at new anti-aircraft training center. Project will include a number of buildings, with mechanical and electrical equipment. No official estimate of cost announced. Public Works Office, Fort Pierce, will be in charge.

UTAH—War Department, Washington, D. C., has authorized extensions in electrical distribution system at Ogden Arsenal, for which bids will be taken at once. U. S. District Engineer Office, 580 State St., Salt Lake City, in charge.

INDIANA—Bureau of Yards and Docks, Navy Department, Washington, D. C., has approved plans for new one-story mechanical and electrical shop at naval station, to cost approximately $200,000, exclusive of equipment. Erection will begin at early date.

KENTUCKY—Kentucky & West Virginia Power Co., Ashland, plans rebuilding of Bellefonte power substation, recently damaged by fire, with loss reported close to $50,000.

DISTRICT OF COLUMBIA—Construction Service, Veterans' Administration, Washington, plans group of new hospitals in 20 states in various parts of country, each comprising a number of one- and multi-story buildings, with complete mechanical and electrical equipment; also, power plant, underground and overhead exterior electrical distribution lines, exterior lighting, electrical elevators, substation units and other electrical facilities. Entire program is estimated to cost $70,000,000, and will be carried out as soon as Federal Board of Hospitalization approves project.

WYOMING—State Department of Institutions, Cheyenne, plans new power plant at State University, Laramie, to cost about $100,000, in connection with a post-war expansion and improvement program at institution, entire project to cost approximately $3,769,000. Also, will remodel and modernize plower plant at State Mental Hospital, Evanston, with installation of additional equipment for increased capacity, similarly to be carried out as a post-war development at institution, with total investment of about $314,000.

NEW JERSEY—Tube Reducing Corp., 520 Main Ave., Wallington, manufacturer of steel tubing, will make extensions in plant for production for government, with additional machinery and electrical equipment. Cost about $220,000, with financing by Defense Plant Corp. Work will be carried out at early date.

LOUISIANA—Louisiana Power & Light Co., New Orleans, plans extension in 7,700-volt transmission line, about 11 miles, for power supply for electrification of Illinois Central Railroad, and lighting state highway bridges. Power substation facilities will be provided to step-down voltage to 2,300 volts at point of delivery. Project has secured a priority rating and will be carried out soon.

OKLAHOMA—City Council, Lawton, plans new municipal airport as a post-war project, including hangars, shops and other buildings, with mechanical and electrical equipment. Also, underground distribution lines, boundary lights and beacon lamps, control station and other facilities. Cost estimated about $1,500,000. Proposed to arrange bond issue in that amount in near future. Everett Glenn, mayor, is active in project.

TEXAS—Sheffield Steel of Texas, Industrial Rd., Houston, a division of American Rolling Mill Co., Middletown, Ohio, will carry out expansion in plant for production for government, including additional building with machinery and electrical equipment. Cost about $450,000, with financing by Defense Plant Corp. Work is scheduled to proceed at once.

OREGON—Northwestern Ice & Cold Storage Co., 73 S. E. Washington St., Portland, will remodel a four-story block-square building at N. W. Everett and Davis Aves., between 13th and 14th Sts., for new cold storage and refrigerating plant for government service, to cost about $300,000, exclusive of equipment. Approximately $400,000 will be expended for machinery and electrical apparatus. Financing in amount of $700,000 was authorized by Defense Plant Corp., several weeks ago.

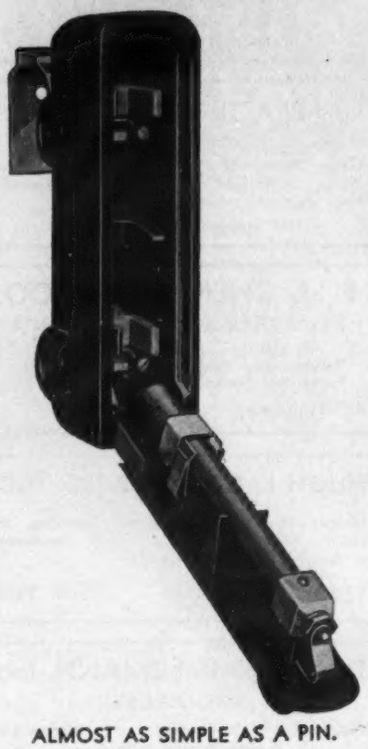
WISCONSIN—Public Works Department, La Crosse, plans extensions in lighting systems in Riverside and Myrick parks, as a post-war project. No estimate of cost announced. John H. Barth is city engineer.

UTAH—Southern Utah Power Co., Cedar City, has secured a priority rating for proposed new steam-electric generating station and work will begin at early date. Installation will include a 2,500-kw. turbine-generator, high-pressure boiler and auxiliary equipment. Entire project is estimated to cost about $300,000, including transmission line for connection with present high-tension system. Completion is scheduled early in May, 1945. Company is affiliated with Washington Gas & Electric Co., Tacoma, Wash.

WASHINGTON — Soundview Pulp Co., Everett, manufacturer of bleached sulphite pulp, plans new by-products plant at mill for production of commercial alcohol from waste sulphite pulp liquor, comprising several large one- and multi-story processing and production buildings, with machinery and electrical equipment for large output. Cost estimated close to $1,300,000. Application has been made for a priority rating.

MICHIGAN—General Motors Corp., Detroit, has contracted with government for expansion in a local plant, and branch plants in Indiana, consisting of additional buildings, with machinery and electrical equipment. Entire program will cost about $10,000,000, with financing by Defense Plant Corp. Work is scheduled to begin at early date.

Non-Indicating Porcelain Housed Matthews Cutouts.



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- Heavyweight hard woven canvas.
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- Rope loop for hanging over pin.
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Write for folder No. EW-44 covering Safety Accessories for the Electrical Industry

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REA Announces New Allotments

Total Rural Electrification Administration loan allotments recently passed the half-billion dollar mark with the allocation of $1,222,500 for loans to 27 borrowers in 17 states. The first REA loan allotments for the new fiscal year, providing for electric facilties for wartime food production, brought the all-time total of federal funds loaned for rural electrification, or set aside for approved loans, to $500,102,301.

Three of the allotments are to provide refrigerated locker facilities:

SOUTH CAROLINA—Electric Cooperative Refrigeration Co., Inc., York, $24,500.

TEXAS—Bowie Cass Refrigeration Cooperative, Inc., Douglassville, $24,000; Collin County Refrigeration Cooperative, Inc., Wylie, $25,000.

The other allotments, for farmstead connections to aid food production, include:

ARKANSAS—First Electric Cooperative Corp., Jacksonville, $50,000.

COLORADO—Union Rural Electric Assn., Inc., Brighton, $50,000; Poudre Rural Electric Assn., Inc., Fort Collins, $65,000.

INDIANA—Whitley County R.E.M.C., Columbia City, $25,000.

IOWA—Winnebago Rural Electric Cooperative Assn., Thompson, $70,000; O'Brien County Rural Electric Cooperative, Pringhar, $45,000.

KENTUCKY—Licking Valley Rural Electric Coop. Corp., West Liberty, $145,000.

MICHIGAN—Western Michigan Electric Cooperative, Scottville, $35,000.

MINNESOTA—McLeod Cooperative Power Assn., Glencoe, $55,000; Faribault County Cooperative Electric Assn., Frost, $50,000.

MISSOURI—Tri-County Electric Cooperative Assn., Lancaster, $67,000.

NEBRASKA—Chimney Rock Public Power District, Bayard, $40,000.

NEW YORK—Oneida - Madison Electric Cooperative, Inc., Bouckville, $37,000.

OHIO—Washington Electric Cooperative, Inc., Marietta, $40,000; Morrow Rural Electric Cooperative, Inc., Mount Gilead, $35,000.

OKLAHOMA—Harman Electric Assn., Inc., Hollis, $100,000.

PENNSYLVANIA—Tri-County Rural Electric Cooperative Assn., Mansfield, $30,000.

SOUTH CAROLINA—Blue Ridge Electric Cooperative, Inc., Pickens, $50,000.

WISCONSIN—Columbus Rural Electric Cooperative, Columbus, $40,000.

Power Production Up 4%

Power production of 348,980,721 kilowatt-hours by the Salt River Valley Water Users Association, Phoenix, Ariz., for the first half of 1944 broke all previous records, according to Harry J. Lawson, general superintendent.

Power generated, originating from the association's hydroelectric, diesel and steam planks and Parker dam, amounted to a four percent increase over the same period last year.

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The Turn-Cuff idea was suggested by the petticoat design of porcelain insulators. The 16 inch Surety Lineman's glove with cuff turned gives added safety by increasing the leakage distance. Only the patented Surety Turn-Cuff has this extra margin of protection for adverse weather . . . or by turning the cuffs back on the arm a 2 inch longer gauntlet for ordinary working conditions.

That's why linemen everywhere specify Turn-Cuffs.

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Radio Engineer for installation, maintenance and servicing essential electronic equipment in United States and abroad. Electrical background and *practical* radio experience required. Age 28-40. Salary $3600 up plus living expenses. Wire or write Radio Division, 2519 Wilkens Avenue, Baltimore 23, Maryland for application forms.

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RA-719, Electrical World
330 West 42nd St., New York 18, N. Y.

Bids: July 27th.

Parkway Lighting Fixtures

Sealed proposals and specifications for the following items may be obtained in the Bureau of Purchase and Supplies, County Office Building, Room 834, White Plains, N. Y.

Bids for the following will be publicly opened and read in the Bureau of Purchase and Supplies, County Office Building, Room 834, White Plains, N. Y., as hereinafter set forth:

Parkway Lighting Fixtures for SALE —July 27th, 1944, at 10:30 A. M., E. W. T.

Purchasing Agent reserves the right to reject any or all bids, or any portion of any bid.

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RA-714, Electrical World
330 West 42nd St., New York 18, N. Y.

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P-722, Electrical World
330 West 42nd St., New York 18, N. Y.

POSITIONS VACANT

WANTED by large utility in middle west electrical engineers familiar with design, operation and maintenance of transmission and distribution systems, also draftsmen for general drafting and design work. These are permanent positions and offer advancement to qualified applicants. State details of age, education, experience, draft status, salary expected and availability. Send photo with your reply. P-716, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

A MUNICIPAL ELECTRIC utility in Alabama requires an efficient meter and relay technician thoroughly competent to repair and test all types of protective relays, watthour and demand meters; also laboratory equipment. In reply state experience, age, references, salary desired and when available. P-723, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

PRODUCTION ENGINEER — fractional h.p. electric motors. Should have specialty background in single phase motors, having devoted major effort to efficient mass production. Line will have limited size range. Engineering design experience desirable for development of motors for tooling and production. Permanent connection with outstanding Southern California manufacturer entering household appliance field. Send detail of experience and personal qualifications to A.W.A., Box 68, Station K, Los Angeles, California.

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GREEN TAG Certified Motor Bulletin No. 38-A: 4 x 9, 52 pages stock list, illustrated and indexed, of new and rebuilt electric motors, generators and power equipment, with illustrations of rebuilding operations and stock. Write Arthur Wagner Co., 1436 West Randolph St., Chicago 7, Ill

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200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
150 HP, 1800 RPM, 440 volt, General Electric, squirrel cage.
150 HP, 1200 RPM, 2200 volt, Westinghouse, squirrel cage.
150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
150 HP, 600 RPM, 440 volt, General Electric, squirrel cage.
500 HP, 900 RPM, 440 volt, Lincoln, sl. rg.
150 HP, 400 RPM, 440 volt, G.E., sq. cg.
145 HP, 600 RPM, 220 volt, General Electric, synchronous
125 KVA, 900 RPM Westinghouse, synchronous
100 HP, 900 RPM, 440 volt, G.E., slip ring.
100 HP, 720 RPM, 440 volt, G.E., slip ring.
100 HP, 720 RPM, 440 volt, G.E., sq. cg.
100 HP, 600 RPM, 440 volt, G.E., slip ring.
100 HP, 600 RPM, 440 volt, G.E., sq. cg.
100 HP, 514 RPM, 440 volt, G.E., sq. cg.
100 HP, 450 RPM, 440 volt, G.E., sq. cg.
90 HP, 400 RPM, 550 volt, Cr. Whlr. sq.cg.
75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
75 HP, 900 RPM, 220 volt, Fairbanks Morse, slip ring.
1—75 HP, 900 RPM, 440 volt, G.E., sq. cg.
1—75 HP, 720 RPM, 440 volt, Westghse, slip ring.
1— 75 HP, 720 RPM, 440 volt, G.E., sq. cg.
1— 50 HP, 900 RPM, 440 volt, G.E., slip ring.
1— 50 HP, 900 RPM, 440 volt, G.E., sq. cg.
1—200 HP, 440 volt, 600 RPM, Crocker-Wheeler, slip ring.

MOTORS—D.C. 230 VOLTS

2—450 HP, 400 RPM, G.E.
1—250 HP, 760 RPM, Electro Dynamic.
1—150 HP, 750 RPM, Electro Dynamic.
2—150 HP, 400/550 RPM, Westinghouse, type SK.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1— 50 HP, 750 RPM, Westinghouse, type SK.
1— 50 HP, 700 RPM, Crocker Wheeler.
1— 40 HP, 775 RPM, Westinghouse.

TRANSFORMERS

4—3000 KVA, General Electric, 14000, with taps, 2400/4150Y.
2— 400 KVA, G.E., 4156-240/480 v., Scott taps.
3— 300 KVA, Pittsburgh, 7500/440 volts.
3— 150 KVA, G.E., 33,000 2300/4000 Y.
3— 100 KVA, Westinghouse, 11,430/250 volts.
1— 100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3— 100 KVA, Westinghouse, 13200 250 volts.
3— 100 KVA, General Electric, 2200-220/110 volts.
3— 100 KVA, Allis-Chalmers, 2200/220/110.
3— 75 KVA, G.E., 13,500-7500/440 volts.
3— 75 KVA, G.E., 2200/220/110 volts.
1— 75 KVA, G.E., 2400/4800/120/240 volts.
1— 75 KVA, G.E., 3 phase, 4156Y-120/208Y.
3— 50 KVA, General Electric, 2200/220/110.
2— 50 KVA, Phgh., 7500/15,000 volts-110/220 volts.
3—37½ KVA, General Electric, 2200/220/440.
2— 30 KVA, Allis Chalmers, 3 phase, 4156Y/120/208Y.
1— 25 KVA, G.E., 220/110-220/110 volts.
2— 15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

2—100 HP, 475/1375 RPM, Electro Dynamic.
1— 90 HP, 470/940 RPM, General Electric.
1— 75 HP, 525/1575 RPM, Electro Dynamic.
1— 35 HP, 500/1500 RPM, Westinghouse.
1— 30 HP, 225/900 RPM, Crocker Wheeler.
2— 25 HP, 300/990 RPM, Electro Dynamic.
1— 20 HP, 750/1500 RPM, General Electric.
1— 15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
2—11½ HP, 500/1500 RPM, Westinghouse, type SK.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

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25—Westinghouse type U recording ammeters with split core CT.
25—Westinghouse type U recording voltmeters.

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600 KW, Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 420 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

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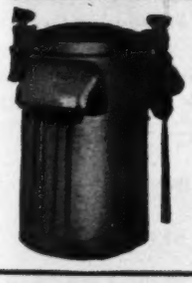
-TRANSFORMERS-



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1—1500	Whse.	720	650	11500
1—1250	G.E.	720	250	2300
1—1000	Whse.	600	250	22000
1—1000	Whse.	900	600	2300
2— 750	Whse.	1200	600	2300/4000

Rotary Converters—3 Ph. 25 Cy.

2—1500	G.E.	500	225/275	6600
1— 500	G.E.	750	225/275	6600

M. G. Sets—3 Ph. 60 Cy.

1—1500	Whse.	514	250	2300/4600
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1— 500	G.E.	900	250	440/2300
1— 500	G.E.	720	600	13200
1— 400	G.E.	720	250	2300

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100 HP. 720 RPM. 3/60/220-440 Volt Gen. Elec.
225 HP. 720 RPM. 3/60/220-440 Volt Gen. Elec.

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50 HP. 600 RPM. 3/60/440 Volt Allis-Chalmers
150 HP. 514 RPM. 3/60/220 Volt Allis-Chalmers
330 HP. 514 RPM. 3/60/440 Volt Westinghouse

DC GENERATORS
55 KW. 850 RPM. 125 Volt DC Westinghouse
75 KW. 500 RPM. 250 Volt DC Northern

AC GENERATORS
50 KW. 1200 RPM. 3/60/2300 Volt Westinghouse
150 KW. 600 RPM. 3/60/220 Volt Gen. Elec.
200 KW. 720 RPM. 3/60/240 Volt Gen. Elec.

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42 KVA. 3/60/240 Volt General Elec.—Brownell
60 KW. 3/60/220 Volt Westinghouse—Ideal
75 KW. 3/60/480 Volt General Elec.—Skinner

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FOR SALE

900 KW Hydro-Electric Power Plant, consisting of 2—450 KW units each, as follows:

450 KW General Electric Generator, Type ATB, 3 phase, 60 cycle, 2300 volt, coupled direct to:

4 Ft. DeRemer-Box Double Water Wheel, double nozzle, 380 ft. head.

Complete with exciters, water wheel governors, switchboards, pipe lines, etc.

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52 Church St. New York, 7, N. Y.

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Advertise it in the ***Searchlight Section*** of **ELECTRICAL WORLD**

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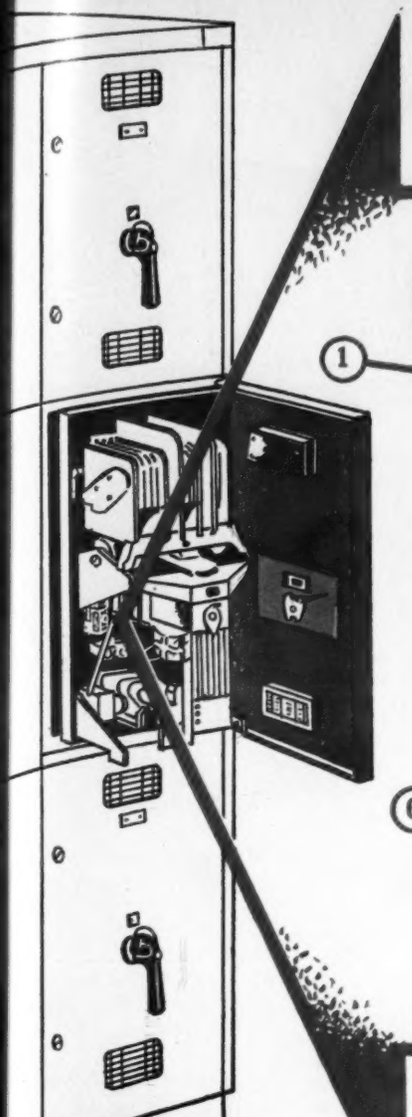
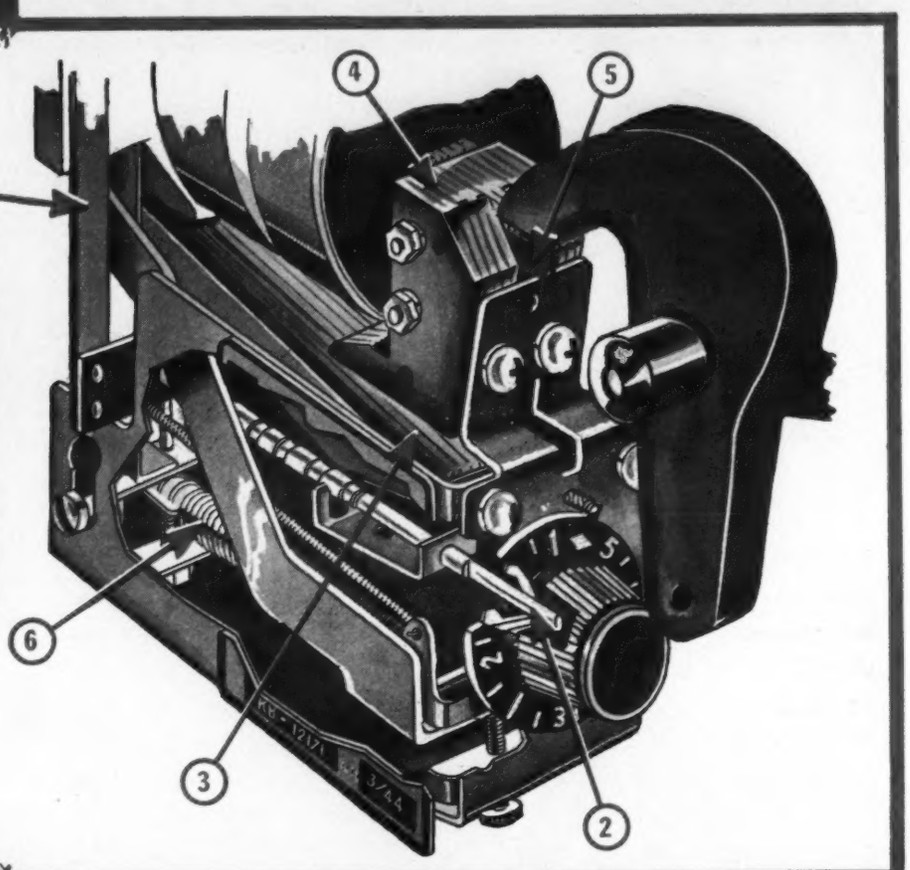
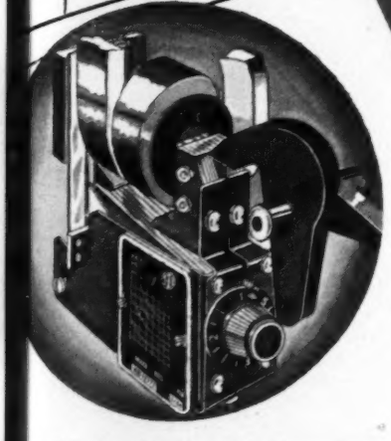
A-C Motors get full protection with this Dual Thermomagnetic Overcurrent Trip







nted on the side of each Thermomag- Overcurrent Trip is a plate showing al time-load curves corresponding to tified dial settings. The dial is notched rmit intermediate settings, numbering n in all. A spring lock prevents acci- al turning of the knob.

(1) **BIMETAL ELEMENT,** heated inductively, causes circuit breaker to open on normal overloads only after a selected time delay. Full voltage starting is permitted with heavy inertia loads yet protection is given against light, continuous overloads such as single phasing. Heating of the element is so arranged as to avoid burnout or permanent distortion. No current flows through the bimetal.

(2) This **SHAFT** is moved forward by the heated bimetal element in starting the action of tripping the circuit breaker. The tripping effect of the forward motion is adjustable at the knob into which the shaft fits. This is like changing the bimetal heating characteristics in relation to the characteristics of the protected motor or in relation to ambient temperature.

(3) This **ARMATURE** moves, in tripping action, either in response to a preselected temperature in the bimetal or to the existence of an overload in the motor circuit equal to twelve times the rated current of the circuit breaker. This gives instantaneous opening on short circuits yet provides time delay for starting peaks and light overloads.

(4) An **ELECTROMAGNET,** energized by a surrounding series coil, has three functions: to attract the armature for direct tripping of the circuit breaker in response to extremely heavy overloads and short circuits; to serve in inductively heating the bimetal element on light overloads and by saturation to control the effect of overcurrents on the heated parts in order to prevent burnout or damage to the bimetal element.

(5) A **TRIPPING PIN** is driven against the latch of the circuit breaker when the armature is attracted to the magnet. Circuit conditions which affect the magnet are directly translated into circuit-opening action when opening is necessary.

(6) This **SPRING,** which carries no current, is preloaded to supply the correct restraint on the armature so that overcurrent of less than 12 times the rated current of the circuit breaker will cause opening only after an exactly appropriate time delay.

In combining the best characteristics of thermal overload devices and magnetic tripping, the I-T-E Thermomagnetic Trip provides protection for individual A-C motors against the effects of both light and heavy overloads. The breaker is tripped before dangerous motor temperatures are reached, but the breaker is not opened needlessly. The time-current characteristics of the device can be adjusted in exact keeping with the heating characteristics of the motor. Motors so protected can be used at full rating. For complete information, call your nearest I-T-E representative or write to I-T-E Circuit Breaker Company, 19th and Hamilton Streets, Philadelphia 30, Pa.

Representatives in Principal Cities

I-T-E

AIR SWITCHGEAR

ARMY E NAVY

I-T-E

What do you want to know about Turbine Oil?

Recently a number of utility plant men were asked, "What do you want to know about turbine oil?" Several of them had very specific questions. They are answered here because they may help you in selecting a turbine oil that solves, once and for all, the ever present problem of turbine oil maintenance. One question is taken up each month, but you can get the answers to all of them now—see the booklet offer.

5. Does the inhibitor in Nonpareil Turbine Oil wear out?

Inhibitors are used in many oils for various purposes, often without users being aware of it. But in Nonpareil the addition of an inhibitor is an important step in its manufacture—it's the key to the oil's long life.

Few, if any, oils are expected to last indefinitely; therefore, the life of inhibitors used in them is not of paramount importance. Since Nonpareil is guaranteed "for the life of the turbine," the lasting quality of the inhibitor *is* important.

It is true that the oxidation inhibitor in Nonpareil is slowly consumed in service. But the user has no cause for concern about it. There are many reasons why. The principal reason is the fact that the inhibitor is used up so slowly—and such a small amount is needed to prevent acidity development—that it is usually amply replenished by the make-up oil. Almost every turbine requires some oil to replace that lost through evaporation and leakage. Normal make-up oil will keep Nonpareil well within the guaranteed limit of acidity formation.

Another reassuring fact is that the oxidation inhibitor has one primary function—to prevent acidity development. The oil itself is free from asphaltene-forming hydrocarbons. Even in the extremely rare case where make-up oil is not sufficient to replenish the inhibitor, there is no formation of asphaltene deposits. However, the possibility of *any* oil trouble because of a deficiency of inhibitor is reduced to practically zero due to the periodic laboratory check that is made of every fill of Nonpareil. Records of thousands of these tests bear out this fact.

What causes corrosion in turbines will be the question discussed in this space next month.

Gasoline Powers the Attack . . .
Don't Waste a Drop!

For all the answers send for this booklet...it contains answers to questions such as these:

1. What causes turbine oil deposits or sludge?
2. What causes acidity increase in turbine oil?
3. What is an oxidation inhibitor—how does it prevent acidity?
4. How does a guaranteed turbine oil protect the user?
5. Does the inhibitor in Nonpareil Turbine Oil wear out?
6. What causes corrosion in turbines?

Send for a copy of this booklet, or better still, ask for a Standard Lubrication Engineer. He can answer your specific questions about Nonpareil Turbine Oil. Write Standard Oil Company (Indiana), Room 1223, 910 S. Michigan Ave., Chicago 80, Ill., for a copy of the booklet, or the Engineer nearest you.

NONPAREIL TURBINE OIL

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE